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ABSTRACT

The question of whether reading methods interact differentially with student sequencing abilities was investigated. One hundred and thirty-one children from three schools in Palo Alto, California, were given reading instruction using a linguistic approach (Palo Alto Reading Program), and 115 children from three Palo Alto schools used a whole-word approach (MacMillan, Harper and Row, and Scott-Foresman). A battery of pretests was administered in September 1969, and a battery of post-tests was given in January 1970, after an instructional period of 70 days. The hypotheses tested were (1) children high in sequencing ability will exhibit higher reading achievement and less learning avoidance behavior in a whole word method than in a linguistic method and (2) children low in sequencing ability will exhibit higher reading achievement and lower learning avoidance behavior in a linguistic method than in a whole word method. The results showed that children high in sequencing ability exhibited higher reading achievement in the linguistic treatment than in the whole word method, while children low in sequencing ability exhibited lower reading achievement in the linguistic treatment than in the whole word treatment. Sequencing ability was negatively correlated with learning avoidance behavior in the whole-word treatment, but was not correlated in the linguistic treatment. References and tables are given. (DE)

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STUDENT APTITUDES AND METHODS OF TEACHING BEGINNING READING:

A Predictive Instrument for Determining Interaction Patterns

Jane A. Stallings - Principal Investigator

Bruce D. Keepes - Project Director
Palo Alto Unified School District
25 Churchill Avenue
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Introduction and Summary

Reading skills are basic to almost all aspects of education, and indeed to modern life in the technical society in which we exist. Unfortunately decades of reading research have not produced agreement on optimal approaches to the complex process of teaching beginning reading. There is, however, evidence to indicate that sequencing ability is related to reading achievement. The question, which has never been fully researched, is whether sequencing ability is related in different ways to different approaches to beginning reading. The present investigation tested this hypotheses that reading methods interact differentially with student sequencing abilities. The two reading methods used were the linguistic approach (Palo Alto Reading Program) and the whole-word approach (Macmillan, Harper & Row, and Scott-Foresman). It was also hypothesized that inappropriate instruction may lead to an approach-avoidance conflict, which gives rise to "learning avoidance behavior." (LAB).

Stated in full, the hypotheses tested were:

1. Children high in sequencing ability will exhibit higher reading achievement and less LAB in a whole word method than in a linguistic method.
2. Conversely, children low in sequencing ability will exhibit higher reading achievement and lower LAB in a linguistic method than in a whole word method.

The 131 children in the linguistic treatment were children who normally go to the schools where the Palo Alto Reading Program is used. There were two classes in each of three schools. Three Palo Alto schools using the linguistic method were matched with three Palo Alto schools using whole word methods. They were matched on the basis of parent income and education. The whole word treatment included 115 children. Assignment of children to classes and of classes to treatments was nonrandom.

The pretests were administered in September, 1969, to all students: The Macmillan Reading Readiness Test (MRRT): The Illinois Test of Psycholinguistic Abilities (ITPA), subtests Visual-Motor Sequencing (VS) and Auditory-Vocal Sequencing (AS); Experimental Visual-Motor Sequencing (X-VS); Experimental Auditory-Vocal Sequencing (X-AS); and specially-designed Observations of Learning Avoidance Behavior (LAB). Final measures of reading ability, sequencing ability, and LAB were administered to all students remaining in the study after the seventy days of the instructional period, in January, 1970. The post-test battery consisted of: reading sections of the California Achievement Test (CAT); the Reading Test, a Linguistic Approach (RTLA); the four sequencing tests (ITPA-AS, ITPA-VS, X-VS, X-AS); and Observations of LAB made in November 1969, and in January 1970.

Correlations and regression analyses were computed separately in each treatment. Treatments were compared on pretests using the *t* statistic. Homogeneity of regression for classes within treatments was examined. Analysis of variance was used to compare sexes, treatments, and classes on selected pretests and all posttests. Multiple regression analyses were computed to predict the two achievement test totals. In addition, three children scoring highest and three children scoring lowest on the X-VS in both treatments were given Stanford-Binet tests, to determine in a crude way whether sequencing ability was strongly related to general intelligence.

Interactions of sequencing ability with reading method were identified by means of the *F test* for parallelism of regression. Once identified, aptitude-treatment interactions were interpreted graphically. Obtained interactions are particularly important when found to be disordinal, that is, when the regression lines relating performance to aptitude in the two treatments cross within the range of the aptitude variable.

Significant differences were found between classes within treatments on the four sequencing pretests and on Observation 1. A significant sex difference was found on the X-AS pretest; girls in both treatments were superior to boys on this measure.

To test the difference of means on the MRRT, t tests were computed for all subtests. No significant differences were found between treatments.

Significant interactions of the type previously described were found between the two treatments. The regression lines relating the ITPA-AS pretest and the two tests of reading achievement crossed within the range of the predictor. Below a score of 15 on the ITPA-AS pretest, a child did better on the average in the whole word treatment, while those with scores above 15 on the ITPA-AS did better on the average in the linguistic treatment (see Figure 4).

The same type of interaction was found with X-VS pretest and the reading achievement tests. High visual sequencing ability as measured by this instrument was more closely associated with high achievement scores in the linguistic treatment. In the whole word treatment, the correlation of the X-VS with the CAT total was .16; in the linguistic treatment the same correlation was .55. The regression lines associated with these correlations cross, if both treatments are graphed on the same set of axes.

Children high in sequencing ability, therefore, exhibited higher reading achievement in the linguistic treatment than in the whole word treatment. Children low in sequencing ability exhibited lower reading achievement in the linguistic treatment than in the whole word treatment.

Further, sequencing ability was negatively correlated with LAB in the whole word treatment, but was not correlated with LAB in the linguistics treatment (see Figure 8). The two experimental sequencing tests X-VS and X-AS were highly correlated with their counterparts in the ITPA, a standardized and reliable test instrument. The ITPA-AS and the X-VS and MRRT emerged as predictors of success in beginning reading in the linguistic treatment, accounting for 51% of the variance in CAT total. The X-VS also emerged as a significant predictor in the whole word treatment, accounting for 6% of the variance.

The performance of the children in the linguistic treatment was significantly better on all achievement tests than was the performance of those in the whole word treatment. Girls were higher in overall achievement, and boys were higher in LAB, using the total of the three Observations. No clear relationship was found between sequencing ability and general intelligence.

The MRRT, ITPA-AS, and X-VS are good predictors of success for the linguistic treatment. This study suggests that schools using linguistic methods might administer the ITPA-AS and the X-VS along with the standard readiness tests.

X-AS and X-VS were significantly correlated with success on both achievement tests in the whole word treatment. However, the MRRT was the best predictor for this treatment.

The present investigation suggests that the linguistic method of teaching reading is superior to the whole word method for most children, as measured by the CAT and the RTLA. However, below a certain level of sequencing ability a child should be placed in a whole word reading method to maximize his chances of success.

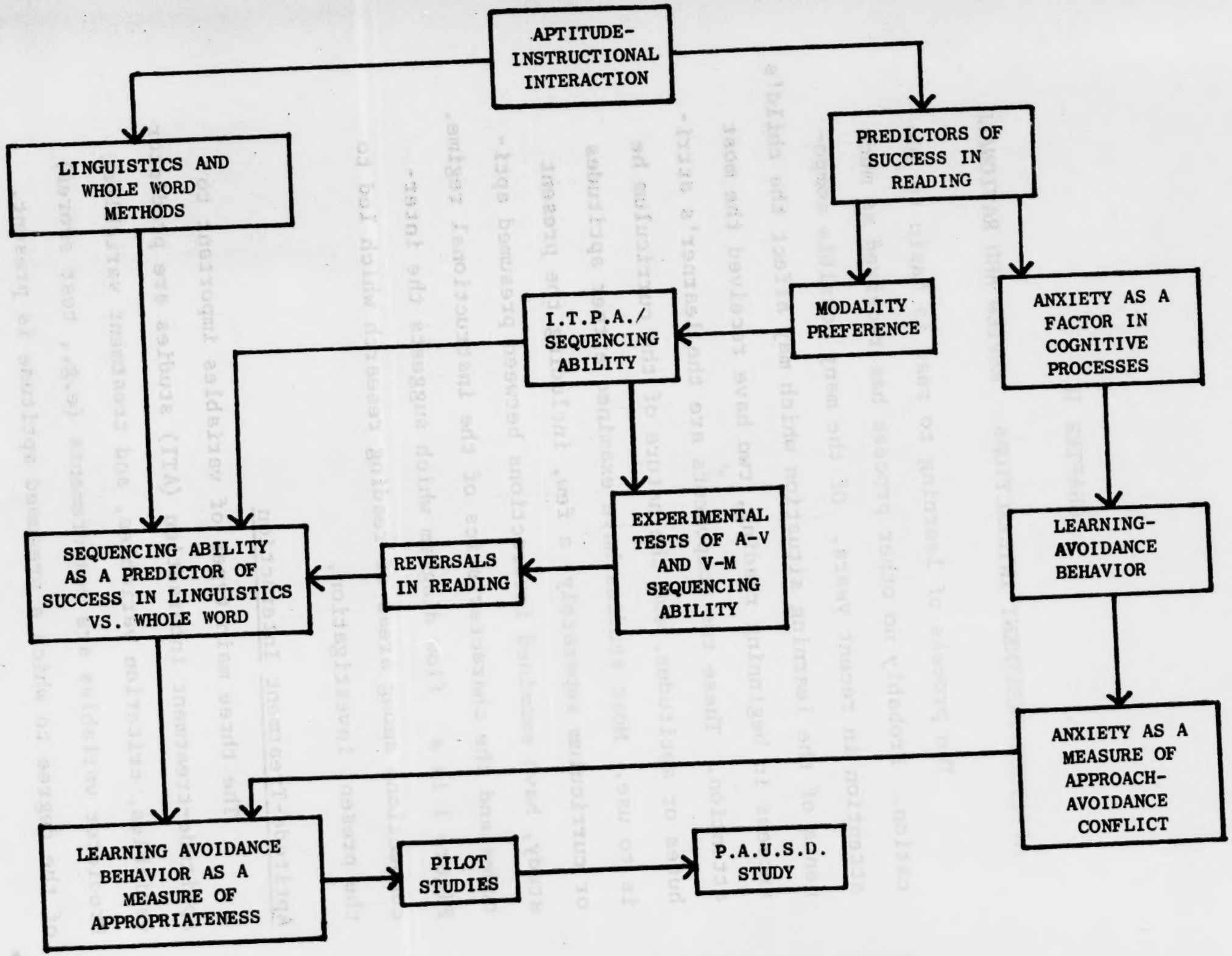
CHAPTER II

APTITUDE-TREATMENT INTERACTIONS: REVIEW AND RATIONALE

The process of learning to read is basic to education. Probably no other process has received as much attention in recent years. Of the many possible components of the learning situation which may affect the child's success in beginning reading, two have received the most attention. These two components are the learner's attributes or aptitudes, and the nature of the curriculum he is to use. Most studies have examined either aptitudes or curriculum separately; a few, including the present study, have examined interactions between presumed aptitudes and the characteristics of the instructional regime. Figure 1 is a flow diagram which suggests the interconnections among areas of reading research which led to the present investigation.

Aptitude-Treatment Interaction

The three main types of variables important to aptitude-treatment interaction (ATI) studies are predictor variables, criterion variables, and treatment variables. Predictor variables are measurements (e.g., test scores) of the degree to which a presumed aptitude is present.


APTITUDE-INSTRUCTIONAL INTERACTION
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PREDICTORS OF SUCCESS IN READING
I.T.P.A./ SEQUENCING ABILITY
MODALITY PREFERENCE
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LEARNING AVOIDANCE BEHAVIOR AS A MEASURE OF APPROPRIATENESS
PILOT STUDIES
P.A.U.S.D. STUDY

FIGURE 1: AREAS OF RESEARCH IN BEGINNING READING.

Criterion variables are measurements relating to outputs of instruction (e.g., achievement scores and behavior observations). Treatment variables are attributes of the instructional situation which can be used to differentiate between two or more types of instruction. These three types of variables are brought together in a model of ATI developed by recent researchers. L. J. Cronbach (1967) provides an introduction to the main feature of this model.

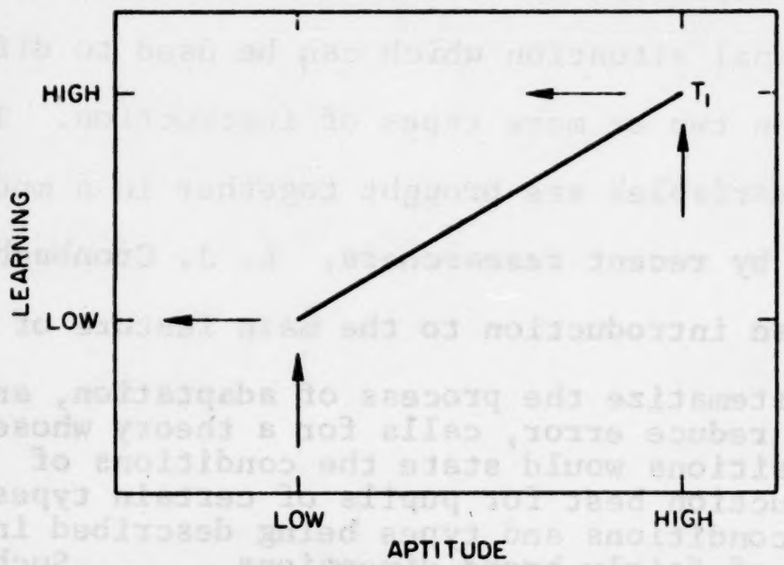
> To systematize the process of adaptation, and hence reduce error, calls for a theory whose propositions would state the conditions of instruction best for pupils of certain types, both conditions and types being described in terms of fairly broad dimensions . . . Such a theory deals with aptitude-treatment interactions.
>
> Aptitude information is not useful in adapting instruction unless the aptitude and treatment interact--more specifically, unless the regression line relating the aptitude to payoff under one treatment crosses the regression line for the competing treatment. . . . (p. 30)

Snow and Salomon (1968, pp. 344-345) present a detailed discussion of the ATI model. This discussion will be quoted in full since it describes, clearly and graphically, an important methodological difference between the present study and previous investigations which have used the same predictor, criterion, and/or treatment variables.

> The traditional academic prediction paradigm, in which some aptitude variable is correlated with achievement in a single instructional treatment, serves as a starting point. In Figure 1, the aptitude variable is positively related to

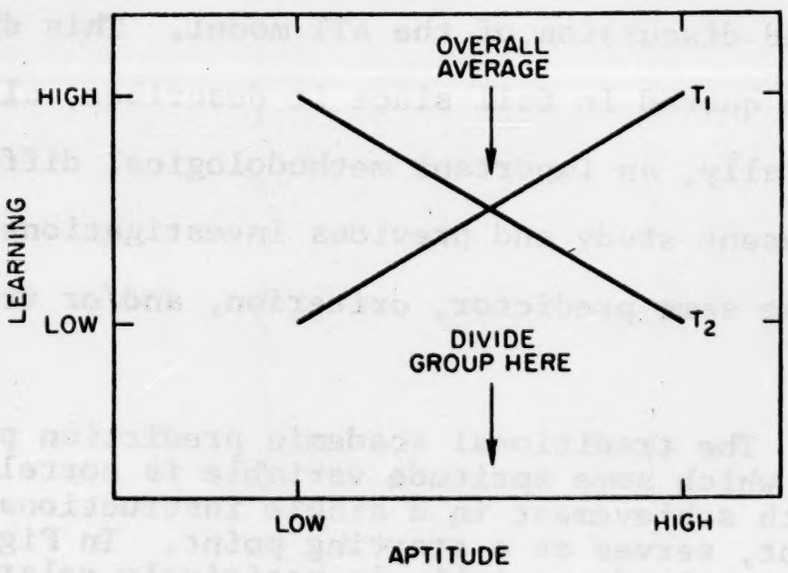
learning in treatment T_1. Individuals with higher aptitude scores learn more than do individuals with lower aptitude scores. Most prior work which has considered aptitudes at all has

FIGURE 1
Regression of Aptitude on Learning in a Single Instructional Treatment.



been limited to this outcome. But this finding is not particularly helpful because we are not simply interested in selecting students who will learn more, we are interested in increasing the learning of everybody. Suppose, however, that another instructional treatment (T_2) can be found or designed in which the same aptitude is differently, even negatively, related to learning--that is, where low aptitude students do especially well. Figure 2 shows what has been called

FIGURE 2
Intersecting Regression Slopes for Alternative Instructional Treatments.



a disordinal interaction. The two regression lines intersect, in this case, near the average of each. An overall comparison would yield no significant difference. But it is quite clear that if we use the aptitude variable to divide the group and assign the two subgroups to different instructional treatments, we can greatly improve the learning of each kind of person. Note that, to use such a finding, it is only necessary that the regression lines for the two treatments intersect (hence, are disordinal) somewhere within the obtained ranges of the aptitude and criterion variables. Note also that, to find the intersection, the regression slopes rather than the correlations alone must be studied.

Had we gone on trying to improve treatment T_1, ignoring the aptitude interaction, some average increase might have been obtained, but it is likely that some students would still have been better off in a different treatment. If, instead, we seek to improve both treatments with specific reference to the functioning of the aptitude variable, then it is likely that the regression slopes rather than the averages will be increased. Selected placement of students in the appropriately tailored treatment condition then maximizes the payoff for both groups.[1]

Review of Research and Rationale for This Study

The two treatments used in the present study are the linguistics method and the whole-word method. A number of variables differentiating the two treatments have been identified. The main differences will be discussed, while other proposed treatment variables of less importance will be mentioned in connection with individual studies.

---

[1]Figures 1 and 2, p. 4, supra, are part of the original article and as such are not included in the numbering sequence of figures in this dissertation.

The predictor variables considered in the present study are sequencing ability and general readiness. A brief review of studies regarding known predictor variables for reading will precede a discussion of research relating directly to the predictors chosen for this study.

The criterion variables used in this study are reading achievement tests, behavior observations, and posttests of sequencing ability. A rationale for the use of these measures will be presented.

Treatment Variables: Linguistics and Whole Word Methods

Anastasiow et al. (1966) have suggested the following five variables on which the linguistic ("structured phonics") approach differs from the whole word ("basal reader," "look-say") method.

1. There is an earlier introduction of letter names and letter sounds in the linguistic programs.
2. There is an attempt to systematically control the introduction of consonant and vowel combinations. Once a vowel and consonant pattern has been introduced, an attempt is made to introduce as many of the family of words as possible (fat, cat, rat, sat, etc.).
3. Emphasis is placed on teaching the child a system of being able to decode the printed word into sounds at the beginning of his reading experience rather than after he has obtained a sight vocabulary. Picture and content clues are not used as decoding devices.
4. Emphasis upon comprehension is less in the early stages of the linguistic program than it is in the early stages of the conventional program. Emphasis is placed upon

pronunciation, either a phonetic approach or analysis of spelling patterns. Identification of the word is through analysis of the pronunciation.

5. There is an attempt to control the syntactic structure of the material presented. Usually a noun, verb, object sentence format is used at the initial stage and more complex structures are introduced later. (p. 6)

Schneyer et al. (1966) discuss two widely used versions, the Fries (linguistic) series and the Scott-Foresman (whole word) series.

> The linguistic readers prepared by Fries and others (1963, 1965) provide beginning reading materials that have been programmed in relatively small steps using spelling patterns as written representations of word patterns. In contrast to the vocabulary of the linguistic reader the basal reader shows wide variation in the number of different letters and sounds. (p. 5)
>
> Two differences between the basal-reader approach and the linguistic approach are the programming of the basic elements of the reading materials and the variety of sentence patterns contained in the beginning reading materials.
>
> The vocabulary of the basal reader is programmed from the standpoint of the carefully controlled number of high-frequency words introduced (as indicated on various word counts of children's reading materials and the reinforcement of recognition of new words through spaced recognition). In the beginning, the words in the basal reader are learned as sight words, and techniques for encouraging word discrimination are gradually introduced through guided apprehension of common elements of words already familiar in print. As each sound element is grasped through study of familiar words, it is employed as a clue to the pronunciation of unfamiliar printed words. The sentence patterns in the basal readers show little variation. (pp. 25-26)

In summary, structural and phonetic analysis of systematically introduced sound and spelling patterns are

the major emphases of the linguistic program. On the other hand, whole word programs are characterized by placing emphasis upon associating words in the child's speaking vocabulary with printed words. The linguistic approach places an emphasis upon understanding later than does the conventional whole-word approach. The whole-word approach places an emphasis on decoding later in its program than the linguistic does. Table 1 offers a comparative summary of the two methods.

A number of studies have attempted to measure the relative effectiveness of these two treatments in terms of reading achievement.

Bliesmer and Yarborough (1965) evaluated ten different beginning first-grade reading programs, including the Lippincott (linguistic) and Scott Foresman (whole-word) used by Bateman (1967). They found that the five linguistic programs were significantly superior to the five whole-word programs on every subtest of the Stanford Achievement Test except Paragraph Meaning.

Bateman (1967), using Lippincott's linguistic method and Scott-Foresman's whole-word method, concluded that the linguistic method was superior for all groups as measured by the Gates Primary Reading Test. The Bateman study, designed to examine the interaction of modality preference and method, is discussed in greater detail on page 17 of this dissertation.

TABLE 1

A COMPARATIVE SUMMARY OF TWO BEGINNING READING METHODS

Linguistic	Whole Word
1. Code emphasis	1. Meaning emphasis
2. Early decoding	2. Decoding after establishing sight vocabulary
3. Systematic control of consonant and vowel combinations	3. Wide variety of letters and sounds used
4. Word discrimination through small steps using spelling patterns	4. Word discrimination through guided study of familiar words, and sentence context
5. Identification of words through analysis of pronunciation	5. Identification of words through association with pictures and highly controlled high frequency words learned as sight words

Chall (1967) examined fifty-three years of research in beginning reading (1912-1965). She divided the research into two groups: the "code-emphasis" (linguistic) approach, involving teaching children to master the alphabetic code prior to actual reading, and the "meaning-emphasis" (whole word) method which presents an initial vocabulary before decoding written symbols.

Summarizing the results of this examination, she states:

> Yet, as I interpret the research that was carried on from 1912 to 1965, an initial code-emphasis method--one that emphasizes learning of the printed code for the spoken language--produces better results, at least up to the end of third grade. There is some evidence, too, that this is particularly true in the case of children of average and lower ability, children of low socio-economic status, and those who are predisposed to reading failure for a variety of other reasons. (1969, p. 37)

Schneyer et al. (1966) measured the reading achievement of a large sample of first-grade children, stratified by socio-economic grouping and general intelligence. One group was taught using the Fries linguistic approach, the other used a basal reader, whole word approach. Criterion measures consisted of a specially prepared test, the Reading Test, a Linguistic Approach (RTLA) and the SAT. The authors concluded that no general statement could be made about the superiority of one approach over the other. In addition, this study strongly suggested that general

intelligence and socio-economic level do not interact with these two reading methods.

A study of 250 children in the Palo Alto Unified School District (Anastasiow et al., 1966; Keepes, 1968) used three criterion measures, the Gates Primary and Advanced Reading Tests, the SAT, and an experimental measure, the PAUSD Linguistic Test. Children in conventional whole word classes were compared to children using a PAUSD-developed linguistic approach, the Story Reading series. The whole word classes scored significantly higher on the Paragraph Meaning subtest of the Gates test, but no other differences on the Gates test were significant. No differences were found using the SAT. The linguistic classes were consistently superior on the PAUSD Linguistic Test. However, this result is untrustworthy. Keepes (1968) evaluated the results with this test, and reported:

> In examining the results of the PAUSD Linguistics Test, it became apparent that this test was highly biased in favor of the students of the Story Reading Program. The vocabulary was drawn almost exclusively from the Story Reading books. This vocabulary was not necessarily the same vocabulary used in the conventional series. Because of this test bias, it was decided to not continue using the PAUSD Linguistic Test as an evaluation instrument.

A suggestion for interpreting these results may be offered. The subtests of a given reading achievement test measure different specific skills.

Observed differences in overall achievement may be due to the relative emphasis of the subtests in contributing to total score. Linguistics groups seem to score higher on spelling, word recognition, and sentence meaning subtests, while whole word groups excel at paragraph meaning. The results are consistent with the pattern of treatment variables differentiating the two treatments.

In the present study, no manipulation of treatment variables was attempted. Comparison of achievement in the two methods was not a primary intent. However, analysis of treatment variables may be helpful in assigning meaning to observed interactions between predictor variables and instruction methods. Moreover, any significant overall superiority of one treatment over the other might obscure the pattern of interaction. Criterion measures are presented in Appendix A, and a brief rationale for the measures chosen may be found on page 32, <u>infra</u>.

The intent of this study was to study the performance of each method with regard to measurable aptitudes related to the presumed task requirements of the two treatments.

<u>Predictor Variables</u>

Aptitude is defined as the ability to profit from instruction of a given sort. "Aptitude, pragmatically, includes whatever promotes the pupil's survival in a particular educational environment . . ." (Cronbach, 1967,

p. 24). A predictor variable is a measure of aptitude if a significant correlation can be shown to exist between scores on the variable and scores on criterion measures.

Known Predictor Variables. As an indicator of the range of possible aptitudes which have been found to correlate with success in beginning reading, two representative studies can be discussed.

DeHirsch, Jansky, and Langford (1966) administered a battery of 32 tests to 53 Kindergarten children. At the end of second grade, a criterion measure which combined the Gray Oral Reading and the Gates Advanced Primary Tests was given. Ten of the 32 tests showed significant correlations (.01) with the criterion, and exhibited relatively normal distribution. These tests were:

Pencil Use
Bender Visuo-Motor Gestalt Test
Wepman Auditory Discrimination Test
Number of Words Used in a Story
Categories
Horst Reversals Test
Gates Word Matching Test
Word Recognition I
Word Recognition II
Word Reproduction (pp. 41-42)

Of the ten tests in this predictive index, three tests were measures of visual or auditory perceptual and sequencing ability. Of these the most important to the present study were the reports on relationship of sequencing ability to reading achievement. DeHirsch stated that without sequencing ability a child would have difficulty

in progressing in linguistic methods of reading.

Hirst et al. (1969) studied reading achievement in 300 kindergarten children, in an attempt to identify predictor variables.

Their results indicated that the most significant predictors of first- and second-grade reading achievement include:

1. Digit Span of the Wechsler Intelligence Test for Children [similar to ITPA auditory sequencing]. The Block Design and Arithmetic subtests add some predictive power for sub-populations.
2. The Numbers subtest of the Metropolitan Readiness Test. The Information and Matching subtests add predictive value for some sub-populations.
3. Visual 3 and Complete-A-Man of the Gesell Developmental Test.
4. Titles from the Minnesota Nonverbal Test of Creativity.
5. Sex for first-grade reading success.
6. Socio-economic status for second-grade reading and arithmetic achievement.
7. Education of the mother.
8. Kindergarten teacher's prediction of the subject's reading ability.
9. Kindergarten teacher's rating of the pupil's socio-emotional growth.
10. Sociometric evaluation of "Number of Times Child Is Seen in a Positive Role." (pp. 61-62)

The authors conclude:

> This research tends to indicate that complicated, expensive, time-consuming measurements of predictive reading and arithmetic success in primary school are no more powerful than the predictive variables listed above. Pattern analysis of the WISC is of little or no value in predicting success in beginning reading.

There is a need, therefore, for diagnostic tests which in addition to the criterion of effectiveness as

predictors of probable success in beginning reading, also meet the standards of low cost, simplicity of design, and ease of administration without extensive training, including the possibility that the teacher could administer and interpret the test. The results of the two studies cited indicate that useful predictive indices can be comprised of selected subtests of standard readiness tests, supplemented by teacher evaluation, school records, and tests of special skills not normally sampled by standard tests.

ATI Studies in Beginning Reading. The goal of aptitude-treatment interaction studies is to identify significant differences in achievement which may be due to the placement in different treatments of students whose scores on predictor measures are known. Among the studies comparing the linguistics and whole word methods, a few have studied ATI effects. The results of such research, if successful, might provide strategies in which each method is found to be highly appropriate, but for a different subgroup of children.

An early study by Bond (1935) suggested one possibility. Using a small sample controlled by matching students, Bond found that "auditory ability" was differentially important under the two instructional regimes, i.e., linguistic and whole word.

> If the pupil is exposed to an oral-phonetic type of instruction, auditory ability appears to be a

> factor of importance in relation to reading disability. If, on the contrary, the pupils are taught by predominantly look-and-say techniques, auditory factors do not maintain their dominant position as characterizing elements associated with inadequate reading performance. (p. 43)

More recently, several studies have re-examined this presumed interaction between "modality preference" (auditory or visual) as a predictor variable and emphasis on auditory versus visual instruction as a treatment variable. In these studies, the linguistics method was differentiated from the whole-word method in that the former emphasizes auditory methods, while the latter emphasizes visual methods.

In general, the later studies do not support Bond's hypothesis. Harris (1965) failed to find any significant association between a specific teaching method used and a presumed aptitude for that method.

Robinson (1968) tested 116 children at the end of first grade and third grade. Children with high visual scores received the whole-word method. Other children with high auditory perception scores received the linguistic approach. She likewise found no difference in achievement that could be attributed to fitting the instructional method to the sense-modality of the child. She concluded that large-scale adaptation of materials to the sense-modality of the child did not appear warranted, but that adjustment might be valuable in the case of an individual child.

Bateman (1967) used eight first-grade classes, four of which used the Lippincott Beginning Program (linguistic-auditory), while the other four used the Scott-Foresman series (whole word visual). Children in two of the linguistic classes and in two of the whole-word classes had been classified as "auditory" or "visual." The predictor measure used was the difference between scores on two subtests of the Illinois Test of Psycholinguistic Ability, ITPA 8 (Auditory-Vocal Sequencing), and ITPA 9 (Visual-Motor Sequencing). Each treatment (linguistics and whole-word) consisted of: (a) one class grouped for high auditory ability (ITPA 8 greater than ITPA 9 by more than nine months language age); (b) one class grouped for high visual ability (difference less than nine months language age); and (c) two classes which were not tested or "placed." At the end of first grade the Gates Primary Word Recognition and Paragraph Reading Test were administered to all eight classes. Comparisons were made between and within treatments, and between "placement" and "non-placement" classes.

> The major findings of this study may be very simply stated: The auditory method of reading instruction was superior to the visual method for both reading and spelling. The auditory modality preferred subjects were superior in both reading and spelling to the visual modality preferred subjects and there was no interaction between the subjects preferred modality and the method of instruction used. (p. 12)

Bateman (1967) concurred in results with the earlier Harris (1965) and with the subsequent Robinson (1968) investigations. Although the Bateman study is similar in many ways to the present study, two differences in method may be pointed out. First, placement of children in classes by ability resulted, in the Bateman study, in there being only two classes in each "cell" of the experimental design. In this situation there is a possibility that teacher and pupil variables may unduly affect the results. In the present study no special pupil placement was made. All students previously assigned to the thirteen classes were tested on the predictor measures. All of the schools using whole word methods were compared for interactions with all of the schools using linguistic methods. Second, the Bateman study divided the students on the basis of auditory versus visual sequencing ability. The present study investigated visual and auditory sequencing abilities in total trying to assess the interrelationship of visual and auditory sequencing, but viewing them both as independent predictors of success in reading achievement.

Predictor Variables in the Present Study

The aptitude variables used in this study were general readiness, sequencing ability, and learning avoidance behavior (LAB).

General Readiness. General Readiness was assessed by the Macmillan Reading Readiness Test. The subtests include Visual Discrimination, Auditory Discrimination,

Visual Motor, and Letter Names.

Sequencing Ability. Sequencing ability in this study does not refer to the global "principle" of sequencing; it refers to the ability to hold a given series of visual or auditory stimuli so that the series can be reproduced in the order in which it was given. The ability to sequence sounds and letters and hold them in short-term memory is related to the reading process. Auditory and visual sequencing ability has been reported to be a factor in cases of severe dyslexia (Rizzio, 1939; Wood, 1964; de Hirsch et al., 1966). However, my classroom experience convinced me that there is no sharp break between severe and moderate reading disability. Sequencing ability could therefore be expected to relate to the task requirements of beginning reading within the ability range encountered in the classroom. The ITPA sequencing subtests have been found to correlate with reading achievement (Bateman, 1967).

The research of Graham M. Sterritt and his co-workers (1966, 1967) concerns the relationship between sequencing ability and reading. They are in the process of developing a battery of sequencing tests to analyze the independent contributions of intelligence and sequence-perceptual abilities to the determination of reading ability. It is hoped that the program, when completed, will yield a clearer picture of the role of various kinds of sequence perceptual abilities in the development of reading skills.

The linguistic and whole word treatments use different approaches to the development of the child's ability to recognize sound-letter combinations and to use this

information to create and recognize new words. If this distinction also involves a difference in the degree to which visual or auditory sequencing ability is a requisite (or prerequisite) ability, an observable aptitude-treatment interaction might be produced.

Predictor Measure: The ITPA. The Illinois Test of Psycholinguistic Abilities (ITPA) has been mentioned in connection with the work of Bateman (1967). As a diagnostic tool, it assesses sequencing problems as well as auditory, visual, and motor deficiencies. The ITPA consists of nine subtests, each one measuring a "specific, discrete language function" (Kirk and Bateman, 1964).

1. Auditory Decoding--the ability to understand what is heard.
2. Visual Decoding--the ability to understand what is seen.
3. Auditory-Vocal Association--the ability to educe relationships from what is heard.
4. Visual-Motor Association--the ability to educe relationships from what is seen.
5. Vocal Encoding--the ability to express ideas verbally.
6. Motor Encoding--the ability to express ideas by motor means.
7. Auditory-Vocal Automatic--the ability to use the structure of language automatically.
8. Auditory-Vocal Sequential--the ability to reproduce a series of symbols presented auditorily.
9. Visual-Motor Sequential--the ability to reproduce a series of symbols presented visually. (p. 10)

In the present study, sequencing ability was used as a predictor variable; of the nine ITPA subtests, only ITPA 8 and 9 were necessary for this measurement. These

tests are not difficult to administer, and in principle could be used by the classroom teacher without extensive outside assistance. To minimize differences in test situations, however, trained testers were used in the present investigation.

Predictor Measures: Experimental Sequencing Tests. The ITPA Auditory Sequencing (ITPA-AS) and the ITPA Visual Sequencing (ITPA-VS) Tests use number sounds and sequences of pictures of objects and geometrical shapes; to represent a closer approximation to the task requirements of beginning reading, two experimental tests were designed on the model of the ITPA, but using only letters and letter sounds. These tests are identified in this dissertation as the Experimental Visual Sequencing (X-VS) and Experimental Auditory Sequencing (X-AS) Tests.

Space is provided on the X-VS test for the tester to record incidences of reversed letters and other evidence of incomplete learning of letter use, although scoring of the tests did not include such occurrences. A tendency to reverse letters has been related to reading disability (Johnson, 1957; Harris, 1961; Lyle, 1968).

Studies of Anxiety as a Predictor Variable

Another aim of this study was derived from previous attempts to treat anxiety as a predictor variable. As a factor in the development of the present study, the dysfunctional relationship of anxiety to learning may be mentioned.

Castaneda et al. (1956) found that the level of anxiety affected learning as tasks became more difficult. Although the experiment lacked adequate control for intelligence, low-anxiety children seemed to perform better than high-anxiety children as tasks became more difficult.

An important series of studies bearing on the effects of anxiety involving primarily cognitive processes was reported by Sarason et al. (1960). In a three-test series, high- and low-anxiety children (as measured on scales devised by the authors) were given Rorschach tests presented as problem-solving situations, human figure-drawing tasks, and a learning task that involved remembering a number associated with a TAT card. They found that children who scored high on the anxiety scales more often missed relevant information in problem solving, and exhibited more errors on the learning task than did the low-anxiety group. These groups were matched on the basis of IQ.

A study by Grimes and Allinsmith (1961) attempted to test the hypothesis that a structured phonics treatment would facilitate reading achievement for students rated more compulsive and self-rated more anxious, while less anxious, less compulsive children would do best with the less structured whole word method. Their results for third graders confirmed this hypothesis in part. Cronbach (1967) says in reference to this study:

> While the structured treatment produced better results for all groups, there was a marked interaction; structure was particularly helpful to the defensive pupils (i.e., high compulsive, high anxiety) . . . Unfortunately, this was not a well controlled study, and one cannot say which of many differences between the structured and unstructured classes produced the differences. (p. 35)

The present investigation did not attempt to treat anxiety itself as a predictor variable. The Grimes and Allinsmith study used only a single variable, degree of structure, to distinguish the two treatments. Possibly the anxiety observed at third grade could have resulted from inappropriate reading treatments at first-grade level. The fact that anxiety may be affected by the instructional setting suggests that changes in anxiety-level might provide an independent measure of the "appropriateness" of aptitude-treatment combinations for individual children.

Criterion Variables

Learning Avoidance Behavior as a Criterion Measure.

Observations of children in beginning reading programs suggested to me that in addition to achievement, other less tangible outcomes result from beginning reading instruction. In this category may be placed the effects of success or failure upon anxiety-level, self-image, and attitude regarding further instruction. Interaction between a given instructional method and the aptitude of an individual child might be examined by measuring the

"less tangible" outputs as demonstrated through certain observable behavior.

Figure 4 is a diagram depicting the proposed model relating aptitude as an input and achievement and behavior as outputs of a given instructional method.

In my classroom experience I had noticed, in children with reading difficulties, apparently unrelated to intelligence, a pattern of behavior which I came to call "learning avoidance behavior." This pattern of distractibility and hyperactivity seemed related to anxiety, and thus could be predicted to interfere with future learning and achievement.

It was hypothesized in this study that the presence of learning avoidance behavior (LAB) represented an anxiety reaction to some aspect of the beginning reading situation. With many children, for example, this behavior was only in evidence or accentuated during reading periods. An observation checklist (see Appendix A) was designed to record learning avoidance behavior. It was hoped that classroom observation using trained observers would give an additional measure of the appropriateness of the type of instruction when related to the child's abilities and limitations as determined by the ITPA and Experimental Auditory and Visual Sequencing Tests.

Dunn (1968) applied a similar assumption to obtain information about "school anxiety," which he hypothesized

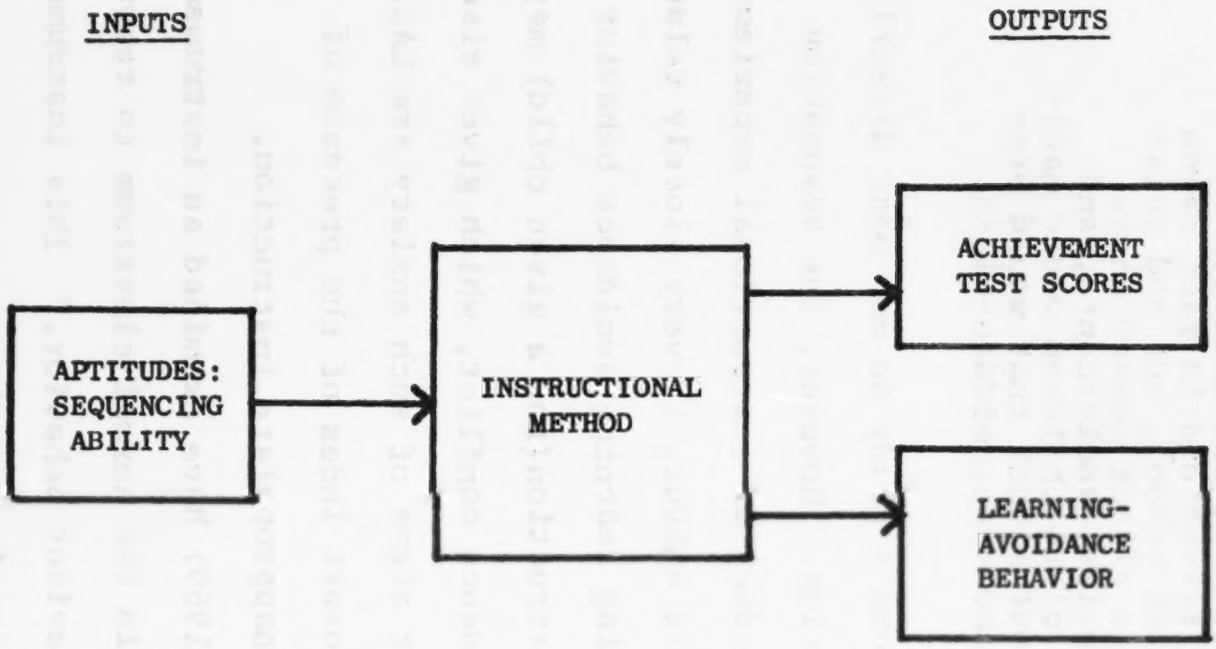


FIGURE 2: A MODEL FOR EVALUATING THE APPROPRIATENESS OF INSTRUCTIONAL METHOD TO APTITUDE.

to be the result of an approach-avoidance conflict. He states:

> On the basis of the Dollard and Miller approach-avoidance paradigm, it was hypothesized . . . that if males, adolescents, and children of lower socio-economic status did in fact value the academic aspects of school, but had relatively little positive affect toward those aspects; then those males, adolescents, and lower socio-economic class children would manifest more anxiety about school that would pre-adolescents, girls, and upper-middle-class children. (p. 389)

The results of Dunn's study do not bear directly on the present investigation. However, the assumption that anxiety may be a product of instructional experience, and therefore a measurable output, is very closely related to my hypothesis concerning learning avoidance behavior (LAB). Inappropriate instruction(for a given child) may lead to an approach-avoidance conflict, which gives rise to anxiety. The manifest signs of such anxiety are LAB. Thus, LAB is used as an overt index of the presence of anxiety in the face of inappropriate instruction.

Werry and Quay (1969) have examined an instrument to be used by observers in the normal classroom to record what the authors term "deviant behavior." This instrument was developed by Becker et al. (1967) to serve as a dependent variable measure of the effect of consultation on elementary school children. Their study of ten normal and three groups of eleven, eleven, and twelve conduct problem children demonstrated that a reasonable level of

reliability and validity can be achieved using the observation method.

Three observations were conducted in the present study. The first, which preceded the instruction period, was treated as a pretest for baseline comparison. The second and third, conducted in the middle and at the end of instruction, were used as criterion posttests.

Three types of criterion variables were used in this study. They were reading achievement, posttests of LAB, and posttests of the ability to sequence.

Reading Achievement was measured using the reading sections of the California Achievement Test (CAT) and the Reading Test, a Linguistic Approach (RTLA) (Schneyer et al., 1966).

Posttests of Learning Avoidance Behavior (LAB) were measured on the second and third observations, at the midpoint and near the end of the instructional period. A rationale for the use of these measures has been presented.

Posttests of Sequencing Ability were measured by giving the ITPA-AS ITPA-VS, X-AS, and X-VS a second time at the end of instruction. The possibility that the two treatments might differ with respect to training children in these abilities has been suggested by Bateman (1967, p. 14).

Pilot Studies

In 1966-1967 a pilot study was designed to examine the several questions brought out in previous discussion. Twenty first-graders at Peninsula Elementary School, Menlo Park, California, were given the ITPA and Experimental Auditory-Vocal and Visual-Motor Sequencing Tests. They were then divided at random into two comparable groups. For the first two months of school, one group received a linguistics treatment (Fries) while the other group received a whole word (Scott-Foresman) treatment. Two teachers (who were unaware of the students' aptitude scores) alternated every two weeks to balance teacher effects. All students were observed periodically, and LAB was recorded. At the end of two months the California Achievement Test in Reading and the Murphy-Durrell Reading Readiness Analysis were administered.

The primary question was how are sequencing abilities related to reading and to reading method. My experience in teaching children to read using the linguistic method led me to believe that children who were limited in sequencing ability had a very difficult time learning to read in that method. The linguistics method requires sequencing small parts of words (c-, r-, -at), holding them in short-term memory, and producing complete words (cat, rat). It seemed that children who had difficulty with this process could learn to read by whole word

configuration and word association with pictures, techniques used in the whole word method. Thus, the hypotheses tested in the first pilot study may be summarized as follows:

1. A child who scored low in ability to perform sequencing tasks would not perform as well, and would exhibit more learning avoidance behavior in a linguistics treatment than in a whole word treatment.
2. Conversely, a child showing high sequencing ability should perform better on criterion tests and exhibit less LAB, in a linguistics treatment than in a whole word treatment.

Analysis of the results, however, suggested the following pattern:

1. Children who rated high in visual sequencing ability performed better on the CAT, and exhibited less LAB under a whole word method than they did under a linguistic method.
2. A similar pattern was observed for children high in auditory sequencing ability.

In 1967-1968 a second pilot study was conducted under circumstances identical to those of the first pilot study. In general, the findings of the first pilot study which related ITPA-VS,achievement and LAB were upheld.

Other results were in the direction of the results of Pilot Study I, but did not reach the .05 level of significance.

These findings showed that sequencing ability was related to success in both treatments, but more closely related in the linguistic treatment. There were no interactions between treatments involving reading achievement. However, the treatments interacted with visual sequencing ability, using LAB as a criterion, just as observed in the first pilot study. Although the second pilot study did not confirm the first study in total, it did indicate that the variables of sequencing ability and LAB are related to success in reading. At the time of the present study it seemed most advisable to hypothesize in the direction of the results of the first pilot study since that was the only evidence, even though there were still theoretical reasons and practical experience to support the rival hypothesis.

Hypothesis

The pilot studies indicated that the instruments described had potential as predictors for methods best suited to individual children. The present study, utilizing 250 first graders, was designed to test the revised hypothesis, as follows:

Children high in sequencing ability will exhibit

higher reading achievement and less LAB in a whole word method than in a linguistic method. Conversely, children low in sequencing ability will exhibit higher reading achievement and lower LAB in a linguistics method than in a whole word approach.

CHAPTER III

PROCEDURES

Design

The basic design of the investigation compared the reading achievement and behavior of seven classes of first-grade children who were taught to read by a whole word approach with the reading achievement and behavior of six classes of first-grade children taught by a linguistic approach. Pretest measures used as independent variables were (a) ITPA and Experimental Sequencing Tests, (b) Observation 1, and (c) all subtests and total score of the Macmillan Reading Readiness Test (MRRT). Interaction analyses were made between these measures and the criterion measures: (a) CAT and RTLA, (b) Observations 2 and 3, and (c) ITPA and Experimental Sequencing Tests given a second time.

Selection of Schools and Teachers

In 1962, Palo Alto Unified School District (PAUSD) developed a beginning reading series using a linguistic approach. Six first-grade classrooms in three schools were selected to use this new series on an experimental basis. It was first used in these schools in 1964.

By the time of the study described in this dissertation, the original six classes were beginning their fifth year of using these materials.

A comparative study had already been made between the six "experimental" classes using the linguistic method and six classes using a whole-word approach (Anastasiow, et al., 1966; Keepes, 1968). The PAUSD study was primarily interested in the longitudinal comparative study of the achievement of children in both groups.

> The Palo Alto Reading Program is designed for grades 1 and 2. In the experimental classrooms the materials are generally used as the core program for grade 1 and beginning grade 2. By the end of grade 2 most of the students are using the Palo Alto Reading Program only as a supplement to other reading materials. Occasionally the Palo Alto Reading Program is used with third graders who are felt by teachers to be having difficulty in reading, but generally the use of these materials ceases by the end of the second grade.
>
> This study is concerned with how well the students read both while they are using the Palo Alto Reading Program and in subsequent grades. That is, if differences between the groups, Palo Alto Reading Program and control, are noted, do they continue? To answer this latter question, the progress of each group (A, B, C and D) has been, or will be, followed through the fourth grade. (Keepes, 1968, p. 4)

The two groups and reading methods available in the PAUSD were well suited for studying the interactions of methods and aptitude. All six teachers who taught in the Palo Alto linguistic program were used in the present experiment. This sample was matched with other schools and teachers according to survey information collected

for the PAUSD, by Bruce D. Keepes, Director of Research.

Description of the Sample for the Present Study

The sample used in this investigation is described below in terms of the community, the schools, the teachers, and the pupils.

Community. Palo Alto is a community of 57,500 (est. 1969) located on the San Francisco Peninsula. The City of Palo Alto is approximately 75 years old, and includes a growing amount of light industry. Estimated mean income (1968) per household is $14,975, with more than 30% of the population in the $8,000 to $20,000 annual earnings category. The Palo Alto Unified School District is approximately 95% Caucasian, 1.5% Negro, with a small percentage of other non-white groups.

Schools. In 1964 the Research Department of PAUSD collected data pertaining to the education and incomes of the parents of the elementary school children of the District. This was done by means of a questionnaire sent to a random sample of parents from each elementary school. The forms were coded according to Hollingshead's Two Factor Social Class Index following modifications made by the PAUSD Research Department. The following information was taken from a 1965 report made by N. Anastasiow, then Research Director, to school principals.

Range of Composite Scores	Social Position
11-17	I
18-27	II
28-43	III
44-60	IV
61-77	V

Note that the lower the score, the higher the social position. For example, a father who is an MD would receive 1 x 4, or 4 points for education; 1 x 7 = 7 points for physician, a total of 11 points. He then would be classified in Level One. A sales clerk who has finished high school would receive 4 x 4 = 16 for education and 4 x 7 = 28 for occupation, a total of 44, or Level Four.

Presented below are the average percentages as of 1965 for the level of the two groups of schools in our study and the total District. The Director of Research, Dr. Bruce Keepes, reports that the school community has remained relatively stable during the past five years.

TABLE 2

SOCIAL CLASS INDEX

Social Class	% Linguistic	% Whole Word	% Total District
I	47	54	48
II	24	24	22
III	16	14	18
IV	11	7	11
V	1	1	2

The six schools in the study were built about the same time over similar L-shaped plans and are of close

approximate size. The classrooms are large, well lighted, and airy.

Teachers. When the schools were selected by the PAUSD Research Department the nature of the experiment was made known to the first-grade teachers. Each teacher was asked individually to participate in the experiment. All of the teachers volunteered to participate. Since there were three first-grade teachers in one school, all of whom wished to participate, and no other school with three first grades, we had uneven treatments of seven whole word classes in three schools and six linguistic classes in three other schools.

All thirteen teachers who participated in the experiment were women. Teachers' average age, total number of years of teaching experience, number of years of first-grade teaching experience, and number of years using their specific reading program, are shown in Table 3.

TABLE 3

AGE AND EXPERIENCE OF TEACHERS

	Whole Word Approach	Linguistic Approach
Average age	38	40
Total years experience	53	69
Total years first grade	37	49
Total years using these materials	37	22
No. of teachers under 5 yrs. experience	2	2

Pupils. At the beginning of grade 1 (September 1969) the thirteen classes participating in the experiment included 275 pupils, of whom 142 were to receive the linguistic approach and 143 were to receive the whole word approach. At the end of the experimental period (January 1970) data were available for 247 pupils of whom 115 were taught by the whole word approach and 131 were taught by the linguistic approach.

Table 4 describes the groups according to range of class size, sex, and ethnic distribution.

TABLE 4

CLASS DATA

	Whole Word	Linguistic
Range of class size	13-23	18-25
No. of boys in sample	66	66
No. of girls in sample	60	65
Percent Negro	1.25	.9

Instructional Materials

The linguistic and whole-word approaches differ in many respects. The main differences in "philosophy" were reviewed in Chapter I. The materials and methods followed in each treatment reflect these contrasting assumptions.

The Linguistic Approach. The Story Reading Program was developed in 1962 by the Palo Alto Unified School District as a new beginning reading series using a

linguistic approach. The series consists of twenty readers with accompanying "Ditto" worksheets. The series is designed to be used as a basal or core program in grades 1 and 2. In 1966 the series was sold to Harcourt, Brace & World, Inc. It is now published as the Story Readers. The program now includes twenty paperbound books, twenty workpads, six teacher's guides, and related materials as shown below:

	Bk.	Workpad	Teacher's Guides	Related Materials
Pre-Book Reading Readiness		Pages 1-33	1	Pocket Chart Big Card Box Children's Spelling Pockets
LEVEL 1 (in general, Grade 1	1 2 3 4 5 6	1 2 3 4 5 6	1 2	Pocket Chart Big Card Box Flannel Board Pattern Cards Children's Spelling Pockets Individual Letter Cards
LEVEL 2 (in general, Grade 2	7 8 9 10 11 12	7 8 9 10 11 12	3 4	Pocket Chart Small Card Box Wall Charts I-VII Children's Spelling Pockets Individual Letter Cards
LEVEL 3 (in general, Grade 3)	13 14 15 16 17 18 19 20	13 14 15 16 17 18 19 20	5 6	Pocket Chart Small Card Box Wall Charts I-VIII Children's Spelling Pockets Individual Letter Cards

The Basal-Reader Approach. The whole word method was taught using the readers, workbooks, and teacher's manuals. The instructional program as described in each accompanying teacher's manual was followed as required in order to provide some control of the type of program being conducted.

The following whole word, basal-reader materials were used:

ON OUR WAY TO READ 1:1 (consumable)		Harper
Phonics Workbooks: (consumable)	PREPRIMERS AND PRIMER 1:2 REAL AND MAKE BELIEVE 1:2	
OFF WE GO WITH STORIES 1:3		
JANET & MARK, OUTDOORS AND IN 1:1		
CITY DAYS CITY WAYS, JUST FOR FUN 1:1		
AROUND THE CORNER 1:1		
REAL AND MAKE BELIEVE 1:1 (Strand One)		
FROM ELEPHANTS TO ESKIMOS 1:3 (Strand Two)		
Pre-Primers:	IN THE CITY 1:1 PEOPLE READ 1:1	Macmillan
AROUND THE CITY 1:1		
UPTOWN, DOWNTOWN 1:1		
WORLDS OF WONDER 1:1 (fast)		
LANDS OF PLEASURE (fast)		
SOUNDS OF NUMBERS 1:3		Holt, Rinehart & Winston
SOUNDS AROUND THE CLOCK 1:3		
PEPPERMINT FENCE 1:4		D. C. Heath
SKY BLUE 1:4		

These books were used with vocabulary cards and teacher's manuals. All children in the whole-word readers group did not necessarily use all of the materials listed above. The number of readers that each pupil completed depended upon the rate of progress of children within each class. For example, some pupils used three readiness books while others used only one.

Supervision of Instruction

The instructional program in each treatment group was determined by the classroom teacher. No attempt was made to direct or interfere with the teachers' use of reading materials. An evaluation was made of teacher adherence to the curriculum method recommended to her by the district. The evaluation was made by a visit to the classrooms in November to assess and list the materials used. The teachers were rated on a three-point scale:

Strictly Adhering to the Curriculum	Occasionally Using Other Materials	Eclectic in Use of Materials
1	2	3

The teachers were also asked what materials they used and how closely they kept to the prescribed curriculum. A second classroom assessment was made in January to examine the extent to which the curriculums were being mixed. All teachers either moderately or strictly adhered to the recommended curriculum materials as shown in Table 5.

TABLE 5

USE OF CURRICULUM READING MATERIALS

Teachers	Strict Adherence	Moderate Adherence	Eclectic
Whole Word			
1	X		
2	X		
3	X		
4	X		
5	X		
6		X	
7		X	
Linguistics			
8	X		
9		X	
10		X	
11	X		
12	X		
13		X	

Testing Program

In September 1969 the thirteen classes were given the Macmillan Reading Readiness Test (see Appendix A) as a pre-test measure of achievement. Report of these data appears in the next chapter. This was administered by trained testers with the assistance of the classroom teachers. At this time each child was individually tested on sub-tests eight and nine of the ITPA and on the two experimental sequencing tests (see Appendix A). Children new to the English language and children already diagnosed as having specific language difficulties were not used in the experiment.

Following the pretest cycle each child was observed for five minutes during the reading period. The behavior was recorded in one-minute intervals on a developed check list of learning avoidance behavior (see Appendix A). The observations were taken when the child was in a small group of children with the teacher, engaged in the process of reading. Similar observations were made in November and again in January. The January observations included observations of the children working with reading materials at their seats, as well as reading in small groups with the teacher. Reliability was examined by having the trainer of the observers and each observer perform ten paired observations, both completing a check list for the same child during the same observation period. Overall reliability was .69.

Each tester observed and tested a class in both the linguistic and whole word treatments. This design was an attempt to control for differences between treatments, but it could not control for differences between classes within treatments.

The validity of the instrument was examined by asking each teacher to rate each child in her class on a five-point scale on general wiggliness, distractibility, and anxiety during the reading period. Anxiety was described as "a worried look when called upon, stuttering, unduly shy, nail biting, finger sucking, twisting hair

or clothing." On another questionnaire they were asked about such behavior during other times of the day (see Appendix A). Local school policy would not permit the use of developed anxiety scales such as the Castaneda-McCandless Anxiety Scale.

In both the linguistic treatment and the whole word treatment the relationship of general intelligence to visual-motor sequencing ability was examined by administering the Stanford-Binet to the three children in each treatment rating lowest on the Experimental Visual sequencing test, and to the three children rating highest on the Experimental Visual sequencing test. This was a total of twelve children tested for general ability and its relation to their ability to sequence. The Experimental Visual test was chosen because it correlated generally better with reading achievement than any of the other sequencing tests.

The posttesting was completed in January. These tests included the same four sequencing tests administered in the pretests, a linguistic test prepared by Schneyer et al. (1966) at the University of Pennsylvania, and the reading sections of the California Achievement Test (see p. 33, supra, and Appendix A.

Treatment of Data

All tests were scored for number correct. Raw

scores were used in all analyses. Raw-score means, standard deviations, standard errors of the mean, and correlation coefficients were computed. The correlation matrix was examined to determine the degree of relationship between pretest variables and criterion variables. The significance of the mean score differences of the pretest variables for treatments and sexes were tested by analysis of variance in a two-by-(two-by-six) factorial design with classes nested within treatments.

Intercorrelations among all variables were then computed separately for each group, and separate regression analyses were computed for each predictor-criterion pair. The F Statistic was used to test for heterogeneity between slopes of the two treatments, thus identifying aptitude-treatment interactions. Significant interactions were interpreted graphically.

CHAPTER IV

ANALYSIS OF DATA

Correlations and regression analyses were computed separately in each treatment. Treatment Groups were first compared on pretests using the t statistic. Homogeneity of regression between classes within treatments was also examined. Analysis of variance was used to compare sexes, treatments, and classes within treatments on selected pretests and all posttests. Multiple regression analyses were computed to predict the two achievement test total scores. In addition, three children scoring highest and three children scoring lowest on the Experimental Visual Sequencing Test (X-VS) in both groups were given Stanford-Binet tests, to check in a crude way whether sequencing ability was strongly related to general intelligence.

Pretests

Macmillan Reading Readiness Test

The Macmillan Reading Readiness Test (MRRT) consists of five subtests designed to measure Visual Discrimination, Auditory Discrimination, Vocabulary and Concepts, Letter Names, and Visual-Motor abilities. The mean, standard deviations and correlations for each subtest

are shown in Table 6. Individual t-tests to compare treatments on pretests were all nonsignificant, indicating that the groups were comparable on these measures.

There were significant correlations between the MRRT subtest Visual Discrimination and the two visual sequencing tests. Though X-VS correlated significantly for both groups, it appeared stronger in the linguistic treatment (.46) than in the whole word treatment (.22).

MRRT Auditory Discrimination correlated significantly with both auditory sequencing tests and with X-VS in the linguistic treatment. In the whole word treatment the correlation was significant only with the X-VS. (See Table 6.)

MRRT Vocabulary and Concepts correlated significantly with X-VS in both the linguistic and the whole word treatments. No other correlations were significant.

MRRT Letter Names correlated significantly with all four sequencing tests in the linguistic treatment. In the whole word treatment, Letter Names correlated significantly with the two visual sequencing tests and with the ITPA Auditory Sequencing Test.

MRRT Visual Motor correlated with other pretest scores about the same as did Letter Names (see Table 6). The correlations for the linguistic treatment again appear higher.

TABLE 6

Correlation Matrix, Means, and Standard Deviations of Pretests

Linguistic N = 131 / Whole-Word N = 115	ITPA Visual	ITPA Auditory	Exper. Visual	Exper. Auditory	Reversals	MRRT Visual Discrimination	MRRT Auditory Discrimination	MRRT Vocabulary & Concepts	MRRT Letter Names	MRRT Visual-Motor	MRRT Total	Observation 1	Linguistic Mean	Linguistic S.D.	Whole Word Mean	Whole Word S.D.
													$\bar{X}$	S.D.	$\bar{X}$	S.D.
ITPA Visual		.12	.66**	.12	-.29**	.22**	.06	.14	.23**	.27**	.27**	-.03	11.16	4.47	12.71	4.21
ITPA Auditory	.10		.28**	.60**	.16*	.22*	.25**	.14	.28**	.32**	.38**	-.21*	24.21	6.32	21.92	6.43
Exper. Visual	.37**	-.01		.26*	-.22*	.46**	.26**	.25**	.39**	.38**	.52**	-.02	13.73	4.29	13.35	3.96
Exper. Auditory	.21*	.53**	-.01		.02	.29**	.30	.13	.28**	.17*	.37**	-.20*	14.82	6.08	15.32	5.89
Reversals	-.05	.02	.08	-.05		-.08	-.01	-.15	-.15	-.00	-.10	-.01	2.84	3.35	0.86	1.47
MRRT Vis. Disc.	.27**	.08	.27**	.12	.05	.05	-.13	-.02	.00	.08	-.02	.08	20.72	2.37	20.36	3.09
MRRT Aud. Disc.	.14	-.07	.20*	-.01	.11		.30**	.18*	.33**	.30**	.60**	.02	13.63	3.99	12.91	3.30
MRRT V & C	.06	-.01	.18*	-.06	.08	.22*		.33**	.29**	.24**	.71**	-.08	24.43	1.79	24.10	2.26
MRRT Letter Names	.18*	.20*	.19*	.10	.01	.10	.11		.36**	.16*	.53**	.08	21.78	3.47	21.09	3.67
MRRT Visual Motor	.20*	.08	.12	.19*	.02	.24**	.21*	.21*		.43**	.75**	-.23*	24.41	3.13	24.03	3.54
MRRT Total	.28**	.12	.30**	.14	.07	.37**	.32**	.12	.34**		.67**	-.13	104.97	9.92	102.60	9.88
Observation 1	.16*	-.05	.03	.20*	.00	.62**	.63**	.37**	.69**	.73**		-.13	9.30	5.59	7.98	4.69

$p < .01 = 23^{**}$

$p < .05 = .16^{*}$

Linguistic Above Diagonal
Whole Word Below Diagonal

MRRT Total Score correlated significantly with all four sequencing tests in the linguistic treatment. The correlation was especially high (.52) with X-VS. In the whole word treatment there were significant correlations only with the two visual sequencing tests. This evidence suggests then that the abilities being measured by the MRRT seem more closely related to the sequencing tests in the linguistic treatment classes than in the whole word treatment classes. It may be that the Kindergarten program in the schools that used linguistic methods had a different instructional program from that used in the schools using whole word methods. Information concerning this possibility was not available from kindergarten school officials.

Sequencing Abilities

The X-VS was highly correlated with the ITPA-VS in both treatments (see Table 7). However, X-VS was significantly correlated with both auditory sequencing tests only in the linguistic treatment. The ITPA-VS was correlated with the X-AS only slightly in the whole word treatment, and was not correlated with the ITPA-AS in either treatment. The X-AS and the ITPA-AS were highly correlated in both treatments, suggesting that the X-AS and ITPA sequencing tests are measuring the same or similar abilities. The pattern of difference in cross-modal

TABLE 7

CORRELATIONS OF SEQUENCING PRETESTS

	X-VS ITPA-VS	X-AS ITPA-AS	X-AS X-VS	X-AS ITPA-VS	X-VS ITPA-AS	ITPA-VS ITPA-AS
Whole Word	.37	.53	-.01	.21	-.01	.10
Linguistic	.66	.60	.26	.12	.28	.12
	$p > .01$	$r = .23$		$p > .05$	$r = .16$	

correlation between the two treatments is not reflected by differences in the means or standard deviations between treatments, as seen in Table 6. The pattern in Table 7 suggests two sources of differences. Although the X-VS and the ITPA-VS apparently measure similar abilities, as indicated by their overall correlation, they must differ in some respects, because within treatments some differences were found in the correlations of the X-VS and the ITPA-VS with a third test, the X-AS. The direction of difference, however, reflects a difference in treatments. The X-VS and X-AS are correlated significantly only in the linguistic treatment. The ITPA-VS and the X-AS are correlated significantly only in the whole word treatment and this correlation is weak. The source of this treatment difference is not yet clear; it too may be related to differences in instructional method at the Kindergarten level.

Special Deviance Indicators from X-VS

Reversals correlated negatively with both visual sequencing tests in the linguistic treatment, but did not correlate with any pretest measures in the whole word treatment. Other deviance indicators, i.e., Upside-Down, Directionality, Verbalizations, and Emotional Response occurred so infrequently that the correlations of these scores cannot be interpreted with confidence. Reports of such deviance indicators might be useful in aiding teachers to adapt special remedial programs to individual children.

Observations

Observation I was treated as a pretest for learning avoidance behavior (LAB). In the linguistic treatment LAB had a significant negative correlation with the two auditory sequencing tests and the MRRT-Letter Names. This suggests that in the linguistic treatment a pupil doing well on these tests might be expected to show less LAB at the first stages of reading instruction. In the whole word treatment, LAB correlated positively with ITPA-VS, X-AS, MRRT-Vocabulary and Concepts, and MRRT Visual-Motor. Pupils scoring high on these tests thus seemed to show more LAB at the time of the pretests.

Analysis of Variance

Analysis of variance was computed for all criterion measures except the Special Deviance Indicators. The design

used to test the means was a 2 x (2 x 6). The sources of differences considered were sex, treatment, and class within treatment.

Sequencing

All of the visual sequencing pretests (I) and posttests (II) and both auditory sequencing posttests showed a significant difference between classes within treatments (see Appendix B). Girls scored significantly higher than did boys on X-AS-I, but the girls did not remain superior to boys on X-AS-II. There were no differences between treatments.

Observations

All of Observations 1, 2, 3, and Total showed significant differences between classes within treatments. In addition boys were significantly higher than girls in LAB on the Total Observation.

Achievement Tests

As with observations and sequencing variables, all of the achievement tests showed significant differences between classes within treatments. Significant sex differences, with girls superior to boys, were found for the CAT Vocabulary Total, CAT Total, and RTLA 1, 2, 3. CAT Vocabulary Total also showed a significant interaction term for sex by treatment. Boys in the whole word treatment

were significantly lower than boys in the linguistic treatment, contributing to the overall lower achievement scores of boys (see Table 8).

TABLE 8

MEAN SCORES OF BOYS AND GIRLS ON CAT TOTAL VOCABULARY

	Boys	Girls	Total
Linguistic	51.36	51.65	51.50
Whole Word	40.52	46.34	43.20
Total	46.11	49.26	47.62

Multiple regression analyses were computed to predict the criterion variables CAT total and RTLA total. It was found that in the linguistic treatment, MRRT total, ITPA-AS-I, and X-VS-I combined to account for 51 per cent of the variance on CAT. In the whole word treatment only MRRT was a significant predictor accounting for 23 per cent. For RTLA, X-VS-I was a significant predictor for the linguistic treatment accounting for 6 per cent of the variance. In the whole word treatment the X-VS-I accounted for 2 per cent of the variance on the RTLA.

Posttest Intercorrelations

Achievement Tests

The California Achievement Test and the Reading Test, Linguistic Approach were positively correlated in

both treatments: .79 in the linguistic treatment and .76 in the whole word treatment. Both of these tests correlated significantly with two-thirds of the 33 variables in the study. (See Table 9.)

Sequencing Tests II

In both treatments, all pairs of sequencing posttests showed significant correlations. At pretest, the intermodal correlations were consistently high, but the intramodal correlations were not as consistent. The posttest results suggested that sequencing ability may be a relatively coherent construct, and that visual and auditory sequencing ability are closely related, not exclusive or contradictory. The continued correspondence between the ITPA and Experimental tests indicates that the two tests probably measure similar abilities.

TABLE 10

CORRELATION MATRIX OF SEQUENCING POSTTESTS

	ITPA-VS	ITPA-AS	X-VS	X-AS
ITPA-VS		.35	.51	.33
ITPA-AS	.24		.35	.57
X-VS	.49	.23		.36
X-AS	.35	.55	.17	

Linguistic above the diagonal $p > .01 = 23$
Whole word below the diagonal $p > .05 = 16$

TABLE 9

CORRELATION MATRIX

Linguistic N = 131

Whole-Word N = 115

	ITPA Visual	ITPA Auditory	Exper. Visual	Exper. Auditory	Reversals	Upside-Down	Total Deviance (10 + 11)	Directionality	Verbalizes	Emotional	MERT Visual Discrimination	MERT Auditory Discrimination	MERT Vocabulary & Concepts	MERT Letter Names	MERT Visual-Motor	MERT Total	Observation 1	Observation 2	Observation 3	ITPA Visual	ITPA Auditory	Exper. Visual	Exper. Auditory	Reversals	Upside-Down	Total Deviance (29 + 30)	Directionality	Verbalizes	Emotional	CAT Vocabulary Total	CAT Reading Comprehension	CAT Total	RTLA Total	Linguistic Mean	Linguistic S.D.	Whole Word Mean	Whole Word S.D.	
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	X	S.D.	X	S.D.	
6. ITPA Visual		.12	.66**	.12	-.29**	-.08	-.26**	-.13	.04	.14	.22**	.06	.14	.23**	.27**	.27**	-.03	-.01	.15	.33**	.23**	.29**	.29**	-.07	.12	-.06	.16*	.16*	.21*	.33**	.28**	.33**	.26**	.29**	11.16	4.47	12.71	4.21	6. ITPA Visual
7. ITPA Auditory	.10		.28**	.60**	.16*	.07	.13	.14	.02	.09	.19*	.25**	.15**	.35**	.32**	.32**	.02	.07	.07	.47**	.37**	.44**	.34**	.12	.08	.10	.11	.22*	.11	.34**	.37**	.44**	.40**	.41**	12.11	4.32	11.42	4.25	7. ITPA Auditory
8. Exper. Visual	.37**-.01			.24*	-.22*	-.03	-.15	-.10	.16*	.03	.14**	.19**	.12**	.25**	.19**	.17**	.07	.07	.07	.47**	.38**	.48**	.35**	.48**	.03	.00	.12	.11	.14**	.41**	.37**	.41**	.44**	13.73	4.29	13.35	3.96	8. Exper. Visual
9. Exper. Auditory	.21*	.53**-.01			.02	.07	.08	-.05	.12	.14	.24**	.30**	.13	.28**	.17**	.17**	.09	.14	.08	.48**	.43**	.44**	.44**	.24**	.08	.13	.11	.02	.05	.10	.09	.10	.02	.05	14.82	6.08	15.32	5.89	9. Exper. Auditory
10. Reversals	-.05	.02	-.08	-.05		.24	.84**	.10	-.09	-.06	-.08	-.01	-.15	-.15	-.00	-.10	-.01	.09	.12	.09	.03	-.04	-.08	.14	.09	.15	-.05	-.07	-.05	-.11	-.10	-.11	-.15	-.21*	2.84	3.35	0.86	1.47	10. Reversals
11. Upside Down	-.14	-.17*	-.00	-.09	.24		.69**	.16*	-.13	-.05	-.02	-.18*	-.15	-.08	-.02	-.14	.14**	.04	.14	.06	.02	-.10	-.03	.16*	.01	.13	-.11	-.02	-.05	-.10	-.09	-.10	-.02	-.05	-.17*	0.60	1.64	0.20	0.70	11. Upside Down
12. Total (10 + 11)	-.10	-.04	.07	-.08	.92**	.33**		.17*	-.11	-.06	-.06	-.09	-.10	-.09	-.01	-.10	.02	.13	.07	.30**	.13	.18**	.13	.03	.02	.05	-.03	.12	-.03	.24**	.18*	.25**	.17*	.19*	3.23	3.96	1.06	1.72	12. Total (10 + 11)
13. Directionality	-.10	-.28**	-.11	-.01	.10	.32**	.22*		.04	.05	.19*	.29*	.00	.12	.15	.11*	.02	.10	.07	.13	.07	.08	.18*	.03	.02	.17*	-.10	-.06	-.06	-.10	-.10	-.10	-.08	-.12	0.05	0.23	0.05	0.22	13. Directionality
14. Verbalizes	.23**-.00		.09	-.04	.10	-.02	.08	-.06			.05	.11	-.07	.13	.11	.08	-.02	.08	.07	.15	.06	.16*	.10	.11	.02	.04	-.03	-.02	.11	.04	.12	.09	.11	.12	.15	0.11	0.31	0.06	0.24	14. Verbalizes
15. Emotional	-.02	.03	.13	.08	.06	-.03	.06	-.02	-.02			.13	.02	.00	.08	.02	.08	.07	.15	.06	.21*	.40**	.21*	.07	.08	.04	-.03	.07	.14	.10	.40**	.39**	.42**	.42**	.46**	0.38	0.19	0.01	0.09	15. Emotional
16. MERT Vis. Disc.	.27**	.08	.27**	.12	.05	.03	.02	.10	.04*	.19*			.39**	.19*	.33**	.32**	.02	.08	.07	.15	.04	.11*	.40**	.04	.04	.03	.07	.12	.13	.38**	.34**	.39**	.46**	.43**	20.72	2.37	20.36	3.09	16. MERT Vis. Disc.
17. MERT Aud. Disc.	.14	.07	.20*	.01	.11	.00	.09	.08	.21*	.08	.22*		.15**	.32**	.24**	.24**	.06	.14	.15	.22	.09	.21*	.26**	.04	.08	.02	-.14	.09	.12	.13	.38**	.34**	.39**	.46**	.46**	13.63	3.99	12.91	3.30	17. MERT Aud. Disc.
18. MERT V & C	.06	.01	.18*	.06	.08	.04	.08	.07	.04	.08	.10	.11			.43**	.73**	.13	.07	.14	.21*	.20*	.33**	.31**	.08	.08	.04	-.03	.07	.14	.10	.40**	.39**	.42**	.42**	.42**	24.43	1.79	24.10	2.26	18. MERT V & C
19. MERT Letter Names	.18*	.20*	.19*	.10	.01	-.16**-.10	-.25**	.14	.05		.17**	.32**	.12			.67**	.13	.03	.04	.14	.06	.14	.15	.12	.09		-.13	-.03	.08	.03	.13*	.18*	.34**	.23**	.23**	21.78	3.47	21.09	3.67	19. MERT Letter Names
20. MERT Visual Motor	.20*	.08	.13	.19*	.02	.10	-.03	.13	.08	.08	.17**	.23**	.12	.34**			.13	.02	.18*	.30**	.18*	.30**	.32**	.06	.03		-.13	.12	.12	.07	.40**	.36**	.47**	.37**	.34**	24.41	3.13	24.03	3.54	20. MERT Visual Motor
21. MERT Total	.24**	.12	.30**	.14	.07	.14	.00	.18*	.00	.12	.62**	.63**	.57**	.66**	.75**			.04	.14	.28*	.18*	.44**	.36**	.08	.03	.08	-.04	.02	.10	.13	.50**	.43**	.50**	.43**	.42**	104.97	9.92	102.60	9.88	21. MERT Total
22. Observation 1	.16*	-.05	.03	.20*	.00	.14	.05	.07	.21*	.14	.07	.07	.20*	.04	.26**	.14			.04	.20*	.06	.22**	.10	.02	.11	.06	.00	.01	.00	.05	.07	.14	.08	.12	.14	.13	.22*	.23**	22. Observation 1
23. Observation 2	.27**	.12	.42**-.04		.07	.03	.05	.15	.08	.05	.20*	.16	.06	.22**	.10	.22*	.25**			.11	.06	.00	.01	.00		.09	.10	.03	.18*	.01	.04	.00	.16	.11	9.30	3.59	7.98	4.69	23. Observation 2
24. Observation 3	.13	.08	.20*	.02	.01	.12	.04	.17*	.05	.10	.06	.18*	.20*	.10**	.01	.20*	.12	.34**		.11	.06	.00	.01	.00	.03	.08	.12	.08	.14	.15	.12	.14	.13	.22*	.23**	9.87	4.96	10.72	4.37	24. Observation 3
25. ITPA Visual	.35**	.07	.29**	.15	.02	.01	.02	.03	.02	.03	.42**	.27*	.14	.11*	.03	.10	.18*	.02	.07							.09	.10	.03	.18*	.01	.04	.00	.16	.11	8.62	4.29	8.89	3.97	25. ITPA Visual
26. ITPA Auditory	.03	.66**-.00		.46**	.01	.04	.02	.10	.11	.01	.11	.03	.10	.25*	.36**	.50**	.17*	.24*	.20*	.44**						.12	.01	.19*	.07	.44**	.44**	.49**	.31**	.36**	14.36	4.31	12.73	4.26	26. ITPA Auditory
27. Exper. Visual	.38**	.05	.40**	.29**	.06	.04	.02	.00	.14	.03	.18**	.39*	.14	.17*	.19*	.22	.06	.02	.07	.10	.24**					.02	.03	.12	.19*	.04	.32**	.42**	.56**	.36**	24.72	6.13	24.25	6.21	27. Exper. Visual
28. Exper. Aud.	.02	.42**-.06		.40**	.01	.01	.06	.16*	.08	.10	.09	.11	.14	.17*	.19*	.09	.20*	.08	.12	.11*	.44**	.17*					.32**	.06	.38**	.12	.56**	.51**	.56**	.41**	.47**	15.60	5.79	15.57	5.31	28. Exper. Auditory
29. Reversals	.22	.15	-.04	.14	.18*	.12	.10	.02	.05	.14	.11	.06	.04	.03	.18*	.09	.20*	.08	.12	.11	.07	.02	.16*				.36**	.06	.28**	.06	.54**	.44**	.54**	.33**	.40**	16.79	6.82	16.42	5.40	29. Reversals
30. Upside Down	.01	.07	-.03	.01	.03	.03	.04	.06	.02	.03	.05	.03	.01	.01	.01	.01	.14	.11	.11	.04	.04	.07	.17*	.03	.00										1.14	1.96	0.97	1.40	30. Upside Down
31. Total (29 + 30)	.20	.16*	-.04	.10	.17*	-.03	.11	.05	.05	.11	.12	.08	.04	.03	.16*	.08	.14	.11	.06	.08	.10	.06	.11	.14	.44**	.49**									0.37	0.83	0.22	0.79	31. Total (29 + 30)
32. Directionality	.20	.04	.14	.00	.01	.04	.00	.03	.03	.01	.00	.00	.00	.09	.02	.08	.04	.10	.14	.08	.10	.06	.11	.14	.44**	.49**	.04	.00	.02	.02	.01				1.48	1.87	1.17	1.61	32. Directionality
33. Verbalizes	.17*	.05	.02	.25**	.06	.06	.03	.09	.03	.20	.07	.01	.01	.04	.00	.02	.15	.03	.12	.18*	.04	.11	.08	.09	.07	.04	.06	-	.07	.27**	.18*	.26**	.13	.19*	0.02	0.12	0.02	0.13	33. Verbalizes
34. Emotional	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.11	.04	.06	-	.10	.08	.10	.12	.08	0.19	0.39	0.18	0.39	34. Emotional
35. CAT Vocab. Total	.14	.14	.14	.23**-.05		.02	.04	.10	.07	.04	.38**	.31**	.11	.39**	.32**	.48**	.06	.17*	.23**	.18*	.29**	.34**	.11*	.13	.16	-.20*	.01	.06	-	.69**					0.08	0.55	0.0	0.0	35. CAT Vocab. Total
36. CAT Read. Comp.	.16*	.06	.21*	.18*	-.12	.08	.07	.13	.05	.02	.26**	.29**	.03	.23**	.17*	.33**	.04	.11*	.21*	.16*	.25**	.16*	.35**	.18*	.17*	.16	-.24**	.04	.13	-	.69**				51.50	13.30	43.20	11.35	36. CAT Read. Comp.
37. CAT Total	.15	.13	.16*	.23**	-.07	.04	.04	.11	.07	.04	.31**	.33**	.04**	.39**	.23**	.44**	.03	.11	.09	.20**	.16*	.24**	.34**	.15	.12	.16	-.22**	.02	.08	-	.99**	.80**	.88**	.67**	4.96	4.34	2.35	3.09	37. CAT Total
38. RTLA 1, 2, 3	.21*	.09	.13	.17*	-.04	-.09	-.07	.10	.14	.03	.26**	.34**	.01	.39**	.23**	.44**	.03	.15	.17*	.20*	.10	.35**	.12	.18*	.14	-.22*	.04	.14	-	.63**	.66**	.67**	.88**	.79**	56.47	17.11	45.75	13.66	38. RTLA 1, 2, 3
39. RTLA Total	.18*	.05	.18*	.15	-.06	0.06	-.08	.10	.11	.04	.30**	.32**	.04	.36**	.25*	.43**	.04	.13	.17*	.18*	.10	.11	.08	.09	.07	.04	-.06	-	.07	.70**	.78**	.76**	.92**	.93**	19.76	6.40	16.24	4.90	39. RTLA Total
																																	26.38	12.40	19.92	8.46	

r .01 = .23** r .05 = .16*

Linguistic -- Above Diagonal

Whole Word -- Below Diagonal

In the linguistic treatment all four sequencing posttests significantly correlated with all five achievement test scores (r = .39). In the whole word treatment eighteen out of the twenty possible correlations reached significance (r = .15), suggesting that the skills required to perform well under the linguistic method of reading are somewhat more closely related at posttest to the sequencing abilities measured by these tests than are the skills required to perform well under the whole word method (see Table 9).

Special Deviance Indicators

Reversals showed negative correlations (-.18 and below) with all achievement test scores in the linguistic treatment. The correlations in the whole word treatment were also negative, but less significant than those in the linguistic treatment. Reversals also shared a signficant negative correlation (-.27) with X-VS-II in the linguistic treatment.

As in the pretests, other deviations, i.e., Upside-Down, Directionality, Verbalizations, and Emotional Responses, occurred so infrequently that the correlations of these statistics cannot be interpreted with confidence.

LAB Posttests

LAB Observation II showed significant negative correlation with the RTLA achievement test

in the linguistic treatment. The correlations in the whole word group were also negative but not significant. There was a significant negative correlation between Observation II and the CAT scores in the whole word treatment, but not in the linguistic treatment.

LAB Observation III correlated negatively with achievement test scores in the whole word treatment. It showed positive correlation (r = .34) with the LAB Observation II, indicating some stability between the two observations in the whole word treatment. However, the corresponding correlation was low (r = .08) in the linguistic treatment. One explanation for this might be found in the nature of the treatments. In the linguistic method the work is programed and the children can more nearly go at their own speed. The brighter students need not wait for others. In the whole word method, each child's progress is more likely to be held to a group rate. The brighter pupils may fidget as they wait their turn and thus evidence more LAB. This pattern might be expected to continue throughout the whole word treatment, but diminish in effect under the linguistic method. However, means do not change on the post LAB scores in either treatment.

Interactions

A significant interaction between the two treatments occurs when the slopes of the regression lines relating variables in the two treatments are non-parallel. Of particular interest for this study are disordinal interactions; those where the slopes intersect within the ranges of the variables. The existence of interaction was tested for all pairs of predictor-criterion variables using the F-Test for non-parallelism of slope (see Table 11).

Achievement Tests

There was significant interaction between the two treatments on the ITPA-AS-I and all five achievement test scores. The implication of these interactions is that auditory sequencing ability is necessary to perform well in the linguistic method of reading. Below a score of 15 on the ITPA-AS-I, however, a child appeared to do better in the whole word method, while those with scores above 15 on ITPA-AS-I achieved more in the linguistic method (see Figure 5 for a regression plot).

X-AS-I interacted significantly with the CAT Reading Comprehension, RTLA Test 1, 2, 3, and RTLA Total. (See Table 11.) While X-AS-I was closely correlated with ITPA-AS-I, the interactions with criterion measures were not as strong for X-AS-I. X-AS-I did not interact with

TABLE 11

Interactions Between Predictor Variables and Criterion Variables

Predictor Variables	Observation II	Observation III	ITPA Vis Seq II	ITPA Aud Seq II	Exp Vis Seq II	Exp. Aud Seq	CAT Vocab Total	CAT Read Comp	CAT Total	RTLA 1,2,3	RTLA Total
ITPA Visual Sequencing I	F= 4.10 L= y=9.97-.01x W= y=14.32-.28x X'= 16.1 R= 2-24	4.67 y=7.02+.14x y=10.42-.12x 13.1 2-24	0.11 not sig.	2.26 not sig.	0.43 not sig.	5.35 y=11.89+.44x y=16.12+.02x 10.18 2-24	2.96 not sig.	2.17 not sig.	2.85 not sig.	0.53 not sig.	1.79 not sig.
ITPA Audio Sequencing I	F= 0.02 L= W= not sig. X'= R=	0.70 not sig.	4.71 y=8.84+.23x y=11.73+.05x 16.1 4-40	0.12 not sig.	8.36 y=6.96+.36x y=14.56+.05x 26.2 4-40	not sig.	8.41 y=29.16+.92x y=37.91+.24x 11.4 4-40	9.73 y=-1.42+.26x y=1.93+.03x 14.56 4-40	9.73 y=27.73+1.19x y=39.84+.27x 13.2 4-40	9.64 y=9.89+.41x y=14.76+.07x 14.1 4-30	13.14 y=7.03+.80x y=18.59+.06x 15.6 4-40
Experimental Visual Sequencing I	F= 14.61 L= y=8.84+.08x W= y=16.84-.46x X'= 14.8 R= 4-30	4.34 y=7.67+.07x y=11.54-.20x 14.3 4-30	1.64 not sig.	8.00 y=17.53+.52x y=24.31-.004x 13.04 4-30	0.16 not sig.	10.67 y=9.48+.53x y=17.48-.08x 13.1 4-30	12.91 y=28.52+1.67x y=37.74+.41x 7.3 4-30	8.96 y=-1.88+.50x y=.39+.16x 6.7 4-30	13.43 ** y=26.62+2.17x y=38.13+.57x 7.2 4-30	5.36 y=12.11+.56x y=14.10+.16x 4.98 4-40	7.25 y=9.43+1.23x y=14.69+.39x 6.26 4-30
Experimental Auditory Sequencing I	F= 1.74 L= W= not sig. X'= R=	0.02 not sig.	0.03 not sig.	0.00 not sig.	0.40 not sig.	2.45 not sig.	1.31 not sig.	7.00 y=.44+.31x y=1.07+.10x 3.0 4-40	3.21 not sig.	6.26 y=13.31+.44x y=14.02+.15x 2.5 4-40	9.81 y=13.20+.89x y=16.58+.22x 5.04 4-40
MRRT Visual Discrimination	F= 9.36 L= y=5.34+.22x W= y=16.61-.29x X'= 22.1 R= 9-24	0.12 	0.78 not sig.	1.20 not sig.	2.06 not sig.	2.25 not sig.	3.40 not sig.	4.83 y=-8.66+.66x y=-2.85+.27x 14.9 9-24	4.18 y=-1.35+2.79x y=17.97+1.36x 13.5 9-24	10.6 y=-5.92+1.24x y=7.73+.42x 16.6 9-24	9.36 y=-20.40+2.26x y=3.40+.81x 16.4 9-24
MRRT Vocabulary and Concepts	F= 0.03 L= W= not sig. X'= R=	0.27 not sig.	0.22 not sig.	0.06 not sig.	0.10 not sig.	0.30 not sig.	6.11 y=-8.55+2.46x y=29.84+.55x 42.2 10-27	4.19 y=-6.44+.47x y=3.62-.04x 19.7 10-27	6.19 y=-15.02+2.93x y=33.46+.51x 20.0 10-27	5.30 y=-.35+.82x y=16.56-.01x 20.4 10-27	4.35 y=-11.70+1.56x y=16.42+.15x 19.9 10-27
MRRT Letter Names	F= 5.65 L= 21.28+0.05x W= 23.07-.19x X'= 7.8 R= 1-23	0.49 not sig.	0.02 not sig.	0.02 not sig.	0.91 not sig.	2.72 not sig.	2.63 not sig.	4.37 y=-5.30+47x y=-1.49+.19x 13.6 6-24	3.40 not sig.	0.65 not sig.	1.05 not sig.
MRRT Visual Motor	F= 0.05 L= W= not sig. X'= R=	0.19 not sig.	0.14 not sig.	2.44 not sig.	0.18 not sig.	2.32 not sig.	6.05 y=.11+2.10x y=18.19+1.04x 17.06 12-29	11.32 y=-10.23+.62x y=-.97+.15x 19.9 12-29	8.12 y=-10.20+2.73x y=17.22+1.19x 17.8 12-29	7.28 y=-1.72+.88x y=8.47+.32x 12.10 12-29	9.04 y=-13.85+1.65x y=8.25+.49x 19.0 12-29
MRRT Total	F= 7.81 L= W= not sig. X'= R=	0.07 not sig.	0.34 not sig.	0.98 not sig.	0.02 not sig.	3.21 not sig.	5.29 y=-38.56+.86x y=-13.86+.56x 82.3 75-120	10.09 y=-20.76+.25x y=-8.01+.10x 85.0 75-120	7.34 y=-59.43+1.10x y=-21.87+.66x 85.4 75-120	6.17 y=-19.83+.38x y=-6.41+.22x 84.0 75-120	8.90 y=-49.33+.72x y=-18.05+.37x 89.4 75-120
Observation I	F= 1.71 L= W= not sig. X'= R=	4.05 y=9.63-.11x y=8.08+.10x 7.4 1-27	4.64 y=15.77-.15x y=12.09+.08x 15.9 1-27	0.97 not sig.	6.54 y=17.15-.17x y=14.04+.19x 9.4 1-27	1.20 not sig.	2.51 not sig.	3.63 not sig.	3.03 not sig.	4.20 y=22.19-.26x y=15.97+.03x 21.4 1-27	4.12 y=30.82-.48x y=19.37+.07 20.8 1-27

F 3.84, $p < .05$; F 6.63, $p < .01$.

Legend:

F =
L = Linguistic
W = Whole Word
X'= Point of Interest
R = Range

ITPA = Illinois Test of Psycholinguistic Abilities
MRRT = Macmillan Reading Readiness Tests
Vis. Seq. = Visual Sequencing
Aud. Seq. = Auditory Sequencing
CAT = California Achievement Test
RTLA = Reading Test:
A Linguistic Approach
OBSERVATION I = Learning Avoidance Behavior

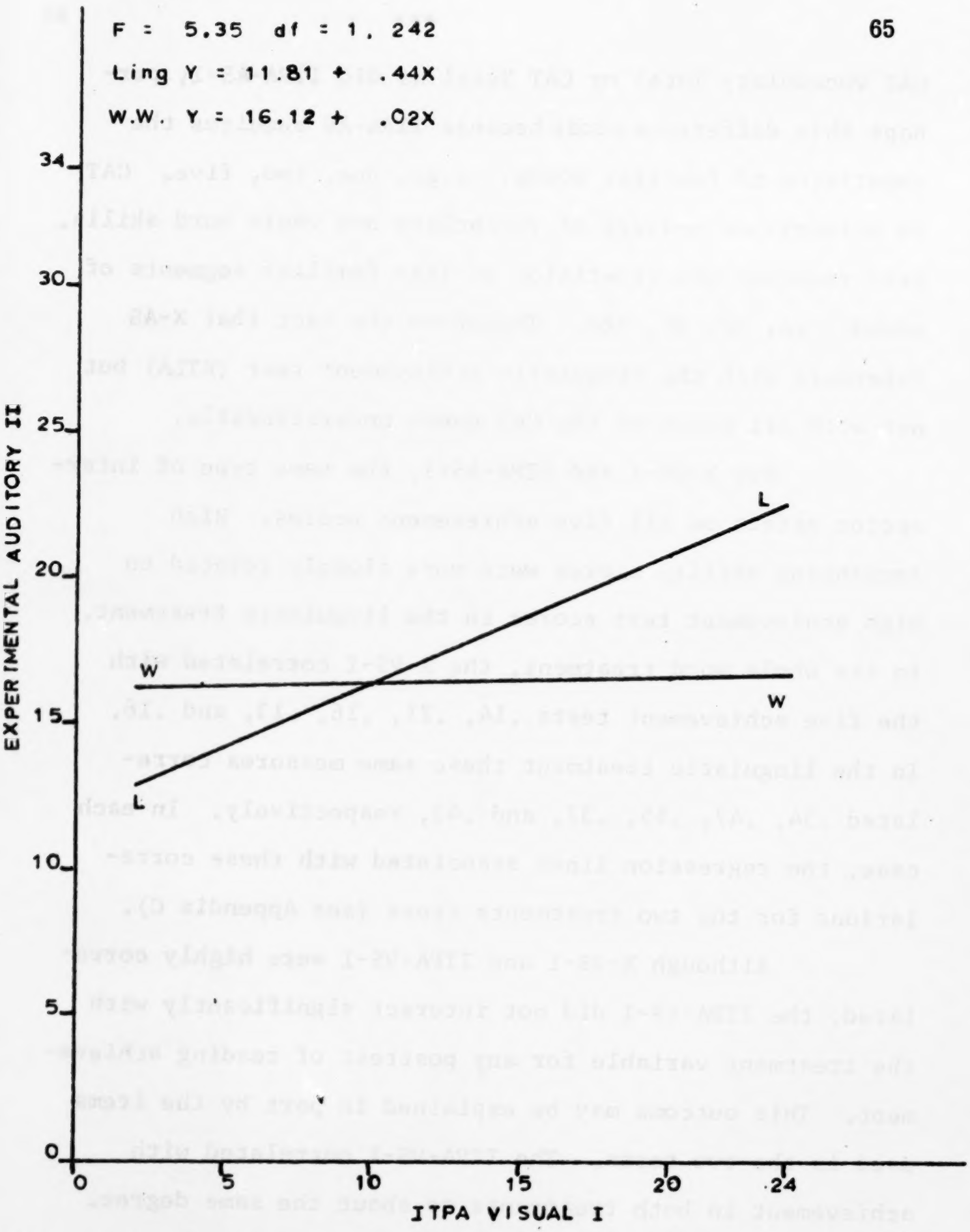


Fig. 3- Regression of Experimental Auditory II on ITPA Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

CAT Vocabulary Total or CAT Total as did ITPA-AS-I, perhaps this difference arose because ITPA-AS requires the repetition of familiar words: e.g., one, two, five. CAT is primarily a measure of vocabulary and whole word skills. X-AS requires the repetition of less familiar segments of sound: ca, ba, da, etc. Therefore the fact that X-AS interacts with the linguistic achievement test (RTLA) but not with all parts of the CAT seems understandable.

For X-VS-I and ITPA-AS-I, the same type of interaction exists on all five achievement scores. High sequencing ability scores were more closely related to high achievement test scores in the linguistic treatment. In the whole word treatment, the X-VS-I correlated with the five achievement tests .14, .21, .16, .13, and .18. In the linguistic treatment these same measures correlated .54, .47, .55, .37, and .43, respectively. In each case, the regression lines associated with these correlations for the two treatments cross (see Appendix C).

Although X-VS-I and ITPA-VS-I were highly correlated, the ITPA-VS-I did not interact significantly with the treatment variable for any posttest of reading achievement. This outcome may be explained in part by the items used in the two tests. The ITPA-VS-I correlated with achievement in both treatments to about the same degree. The items used (small pictures of geometric forms, see Appendix A) may more generally represent the abilities

required in both reading treatments; thus, there were no interactions between treatments on these measures. The items used in the X-VS-I (lower case letters, see Appendix A) may more specifically represent the sequencing abilities required in the linguistic treatment (which requires grouping letters to form words) than the sequencing abilities required in the whole word treatment, thus there were interactions.

MRRT subtests Visual Discrimination, Vocabulary-Concepts, and Visual-Motor interacted significantly with the achievement tests (see Table 11). It appears that some factor in the linguistic treatment is related to the ability being measured in each of these tests. If a pupil in this treatment was high on MRRT Vocabulary-Concepts in September, he scored high on both achievement tests in January. Pupils scoring in the lower ranges of the MRRT may achieve more success in the whole word treatment, since the method is not as dependent upon the analytic skills these tests represent (see Figure 6).

Sequencing Abilities as Criteria

Using sequencing abilities as criteria the analysis showed a significant interaction between two treatments and the predictor variable ITPA-VS-I, on criterion variable X-AS-II. The regression lines indicated that if a pupil scored above 10 on ITPA-VS-I, he was likely to

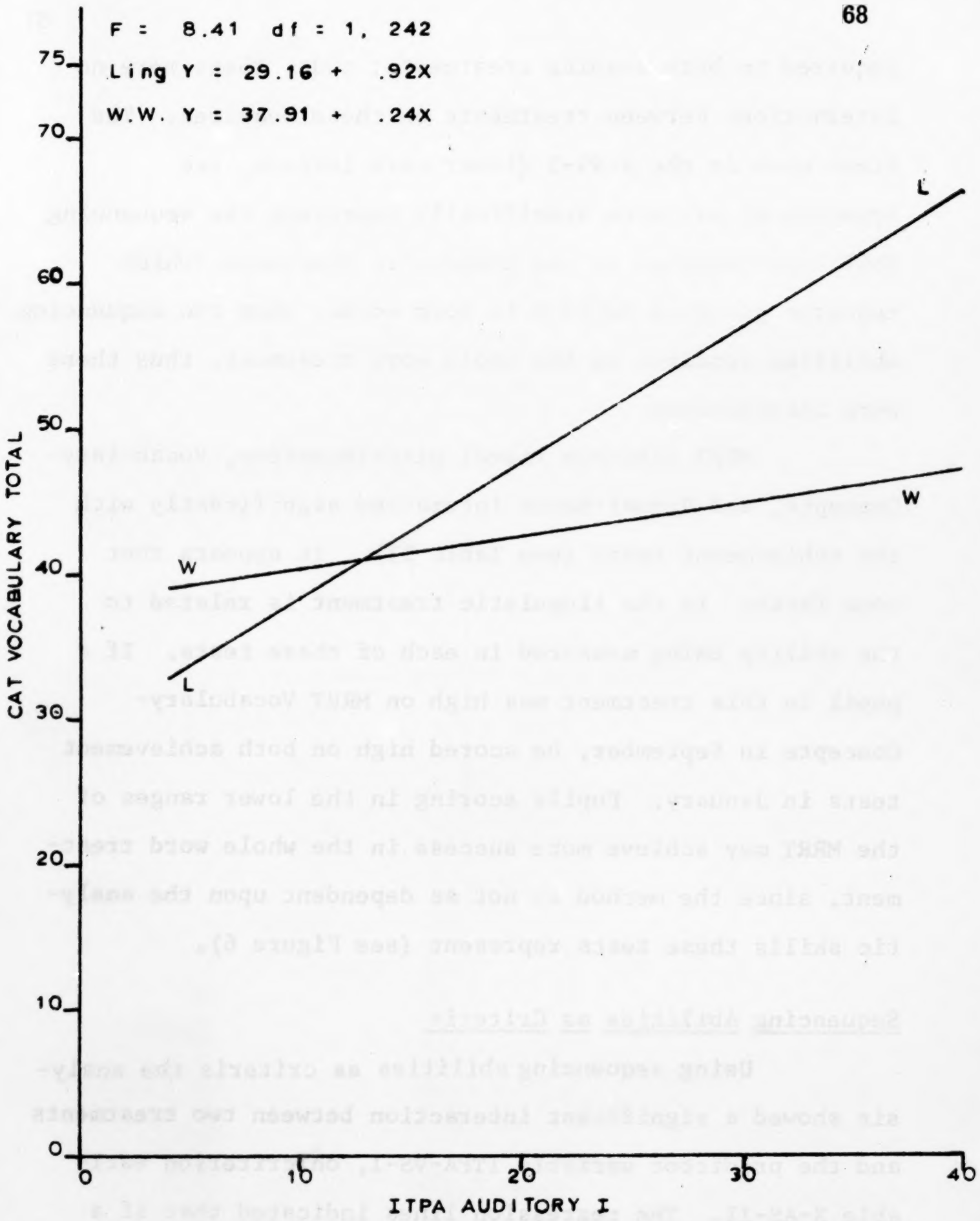


Fig. 4--Regression of CAT Vocabulary Total on ITPA Auditory I for Linguistics (L) and Whole Word (W.W.) Treatments.

score higher on the X-AS-II in the linguistic treatment; there was no relation in the whole word treatment between these variables (see Figure 7).

X-VS-I interacted significantly with both post auditory sequencing tests (see Table 11). Again it appeared that if a pupil is high on one sequencing ability in the pretest he will continue to be high in that ability and also be high in the opposite sense modality in the post-test if he is in the linguistic treatment. Similar significant relationships were found between predictor variable ITPA-AS-I and both of the visual sequencing post-tests, ITPA-VS-II and X-VS-II (see Table 6 and Appendix C). All of these interactions seem to suggest that if a pupil scores high on a sequencing pretest, visual or auditory, he will also score high on the opposite mode in the post-test if he is in the linguistic treatment. In the whole word treatment pretest sequencing scores are unrelated to posttest sequencing tests in the opposite sense modality. Differences between treatments in the correlation of these measures at posttest may be accounted for in part by differences between treatments in correlations on these same measures at pretest. Why the treatment groups correlated differently on these measures at pretest is not clear.

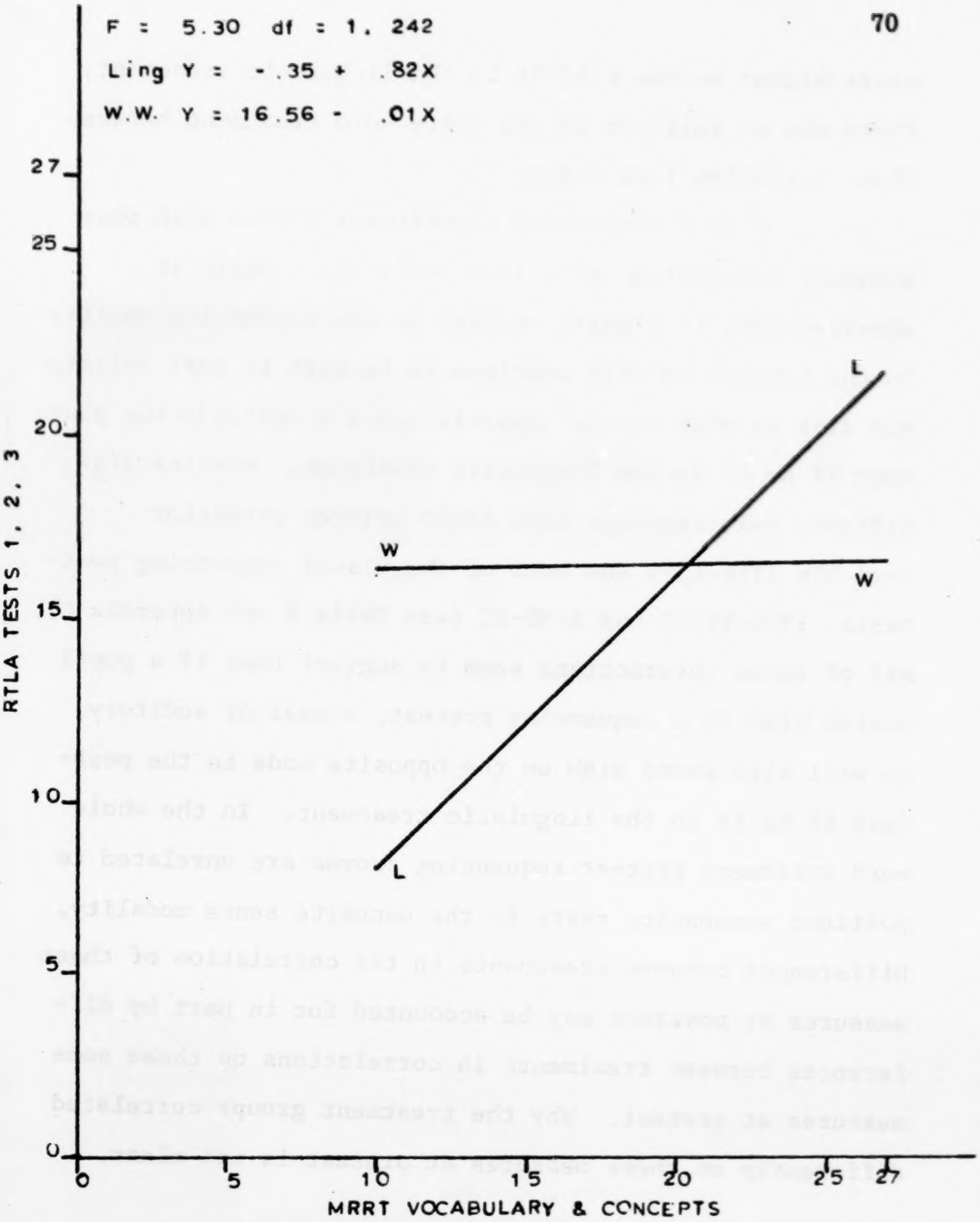


Fig. 5--Regression of RTLA Tests 1,2,3 on MRRT Vocabulary and Concepts for Linguistics (L) and Whole Word Treatments.

Observations

The LAB of Observation 1 showed a significant interaction with both visual sequencing posttests. Pupils who scored high in Learning Avoidance Behavior (LAB) in September scored high in Visual Sequencing Ability in January, if they were in the whole word treatment (see Figure 8). In the linguistic treatment the slope was negative. High LAB in September is associated with low visual sequencing ability in January. There were no differences at pretest. This may indicate that the linguistic treatment requires closer attention from pupils and can affect sequencing ability positively when LAB is low. The tasks on the sequencing tests themselves require attention from the pupil. He must look carefully at the given sequence of items, hold them in short-term memory while they are mixed, and replace them. It is reasonable to expect that the linguistic method, which is based upon identifying small units (letters) and putting them together in predetermined sequences (words), would positively affect the sequencing abilities of those children who could give the required attention (low on LAB). This hypothesis is supported by the fact that the children scoring low in LAB in September also scored high on the achievement test scores in January if they were in the linguistic treatment (see Figure 9).

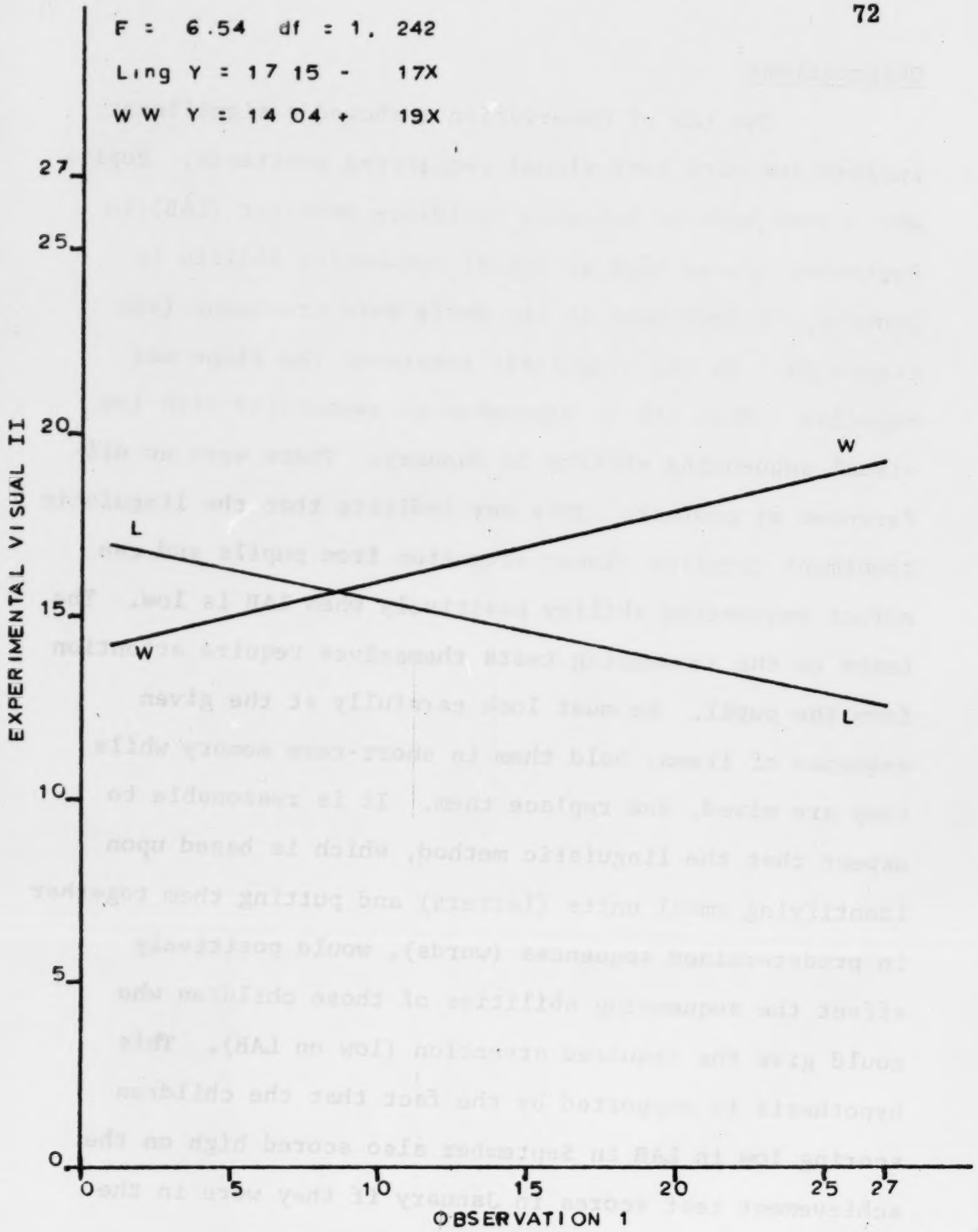


Fig. 6--Regression of Experimental Visual II on Observation 1 for Linguistics (L) and Whole Word (W.W.) Treatments.

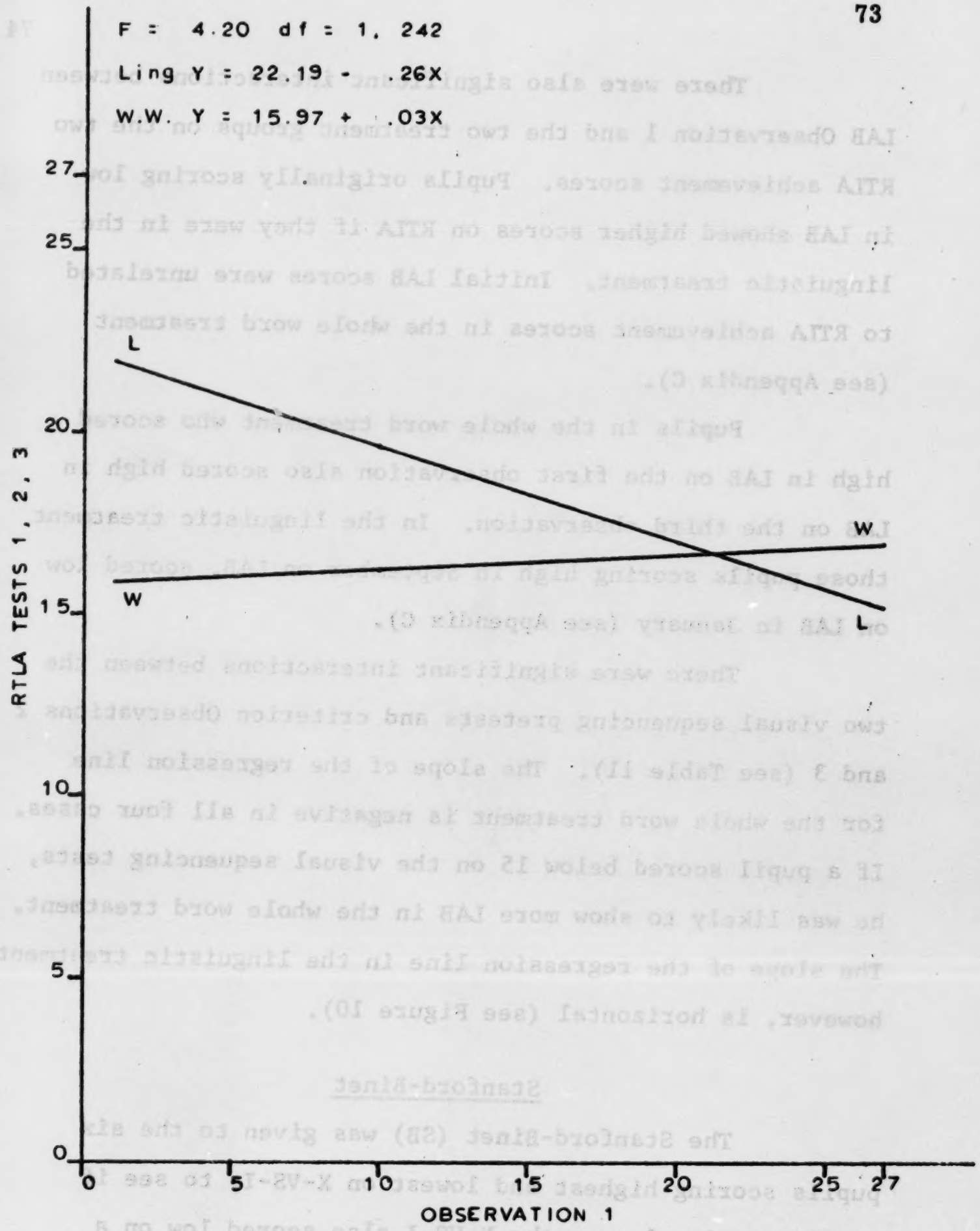


Fig. 7--Regression of RTLA Tests 1,2,3 on Observation 1 for Linguistics (L) and Whole Word (W.W.) Treatments.

There were also significant interactions between LAB Observation 1 and the two treatment groups on the two RTLA achievement scores. Pupils originally scoring low in LAB showed higher scores on RTLA if they were in the linguistic treatment. Initial LAB scores were unrelated to RTLA achievement scores in the whole word treatment (see Appendix C).

Pupils in the whole word treatment who scored high in LAB on the first observation also scored high in LAB on the third observation. In the linguistic treatment those pupils scoring high in September on LAB, scored low on LAB in January (see Appendix C).

There were significant interactions between the two visual sequencing pretests and criterion Observations 2 and 3 (see Table 11). The slope of the regression line for the whole word treatment is negative in all four cases. If a pupil scored below 15 on the visual sequencing tests, he was likely to show more LAB in the whole word treatment. The slope of the regression line in the linguistic treatment, however, is horizontal (see Figure 10).

Stanford-Binet

The Stanford-Binet (SB) was given to the six pupils scoring highest and lowest on X-VS-I, to see if pupils scoring low on the X-VS-I also scored low on a general intelligence test. Test information was not

F = 4.10 df = 1, 242

Ling Y = 9.97 - .01X

W.W. Y = 14.32 - .28X

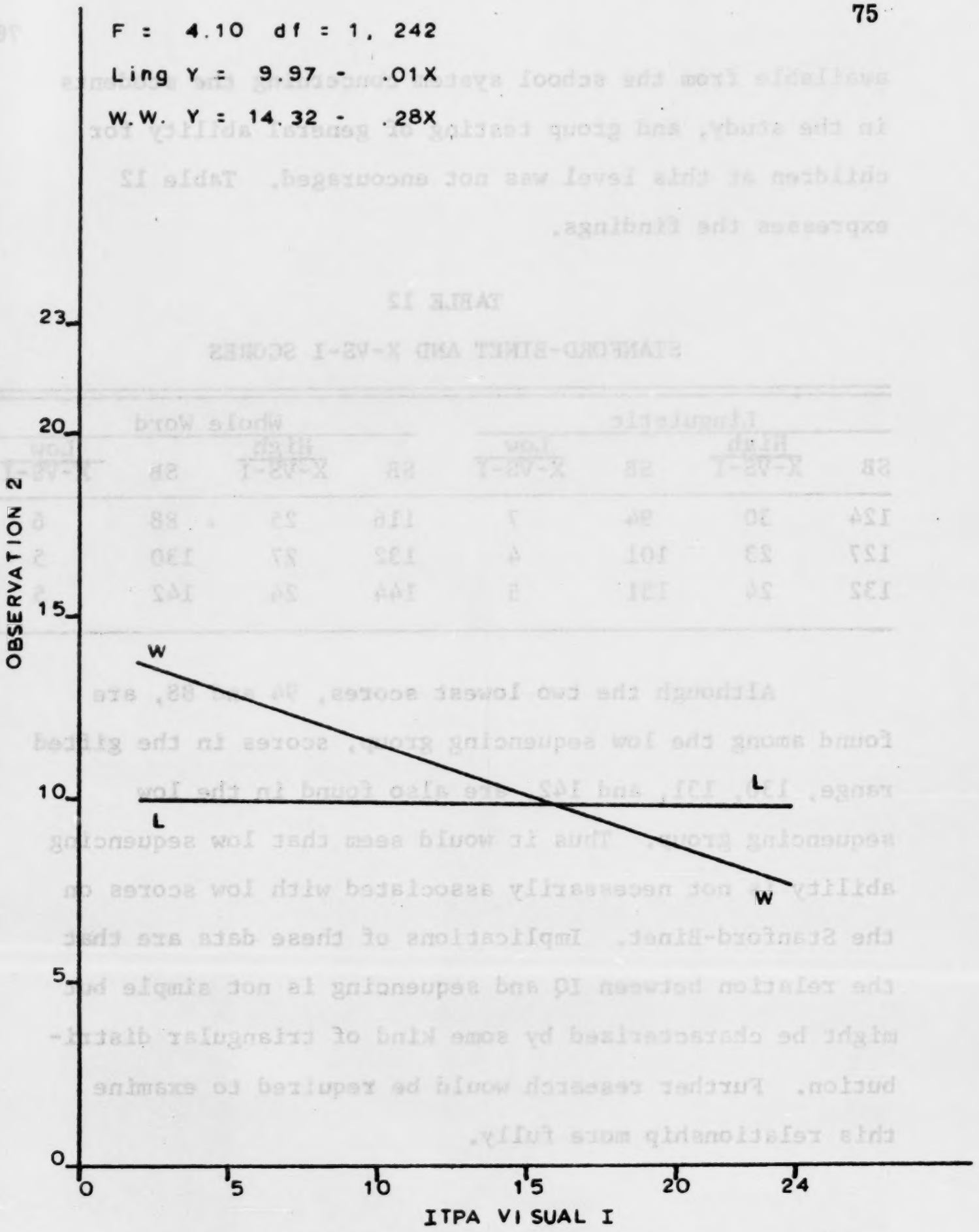


Fig. 8 --Regression of Experimental Observation 2 on ITPA Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

available from the school system concerning the students in the study, and group testing of general ability for children at this level was not encouraged. Table 12 expresses the findings.

TABLE 12

STANFORD-BINET AND X-VS-I SCORES

Linguistic				Whole Word			
	High		Low		High		Low
SB	X-VS-I	SB	X-VS-I	SB	X-VS-I	SB	X-VS-I
124	30	94	7	116	25	88	6
127	23	101	4	132	27	130	5
132	24	131	5	144	24	142	5

Although the two lowest scores, 94 and 88, are found among the low sequencing group, scores in the gifted range, 130, 131, and 142, are also found in the low sequencing group. Thus it would seem that low sequencing ability is not necessarily associated with low scores on the Stanford-Binet. Implications of these data are that the relation between IQ and sequencing is not simple but might be characterized by some kind of triangular distribution. Further research would be required to examine this relationship more fully.

CHAPTER V

SUMMARY, CONCLUSIONS, AND DISCUSSION

The major objective of the present investigation was to test an interactional hypothesis in the field: to see if reading methods interact differentially with student sequencing abilities. The two reading methods used were Palo Alto Story Readers (a linguistic approach) and several whole word basal readers; Macmillan, Harper Row, Scott Foresman.

Summary

Population

The 142 children selected for the linguistic treatment were those children who normally go to the schools where the Palo Alto Story Reading Program is used. There were two classes in each of three schools. These three Palo Alto schools using the linguistic method were matched with three Palo Alto schools using whole word methods, on the basis of average parent income and education. The matching whole word method schools had seven first-grade classrooms. Since all of the seven teachers wanted to take part in the experiment, data were collected from the seven classes. At the time of data analysis,

the smallest class was dropped from the sample to balance the design. The linguistic treatment was ultimately comprised of 131 students; the whole word treatment included 115 students.

Tests

The following pretests were administered in September 1969: The Macmillan Reading Readiness Test (MRRT), Illinois Test of Psycholinguistic Abilities (ITPA) subtests Visual-Motor Sequencing (VS) and Auditory-Vocal Sequencing (AS), Experimental Visual-Motor Sequencing (X-VS), Experimental Auditory Sequencing (AS), and Observations of Learning Avoidance Behavior (LAB). As final measures of reading ability, the following tests were administered to the 246 pupils remaining in the study after the seventy days of the instructional period, in January 1970: reading sections from the California Achievement Test (CAT), Reading Test Linguistic Approach (RTLA), the four sequencing tests (ITPA-VS, ITPA-AS, X-VS, X-AS) and Observations of LAB made in November 1969 and January 1970.

Findings

Summary of Results for Predictor Variables

In order to check initial differences between the two treatment groups at the beginning of the experiment, analysis of variance procedures were used to test the mean

differences between treatments, sexes, and classes within treatment for the four sequencing tests and Observation I.

A significant difference was found between classes within treatments in all of the variables analyzed, indicating that classes were not comparable in ability to begin with, but that treatment groups did not differ on the whole. F tests for non-parallelism between classes were computed and the assumption of homogeneity between classes within treatments was found to be tenable. The only other significant difference between means was found in the X-AS; girls in both treatments were superior to boys on this measure.

Summary of Results for Criterion Variables

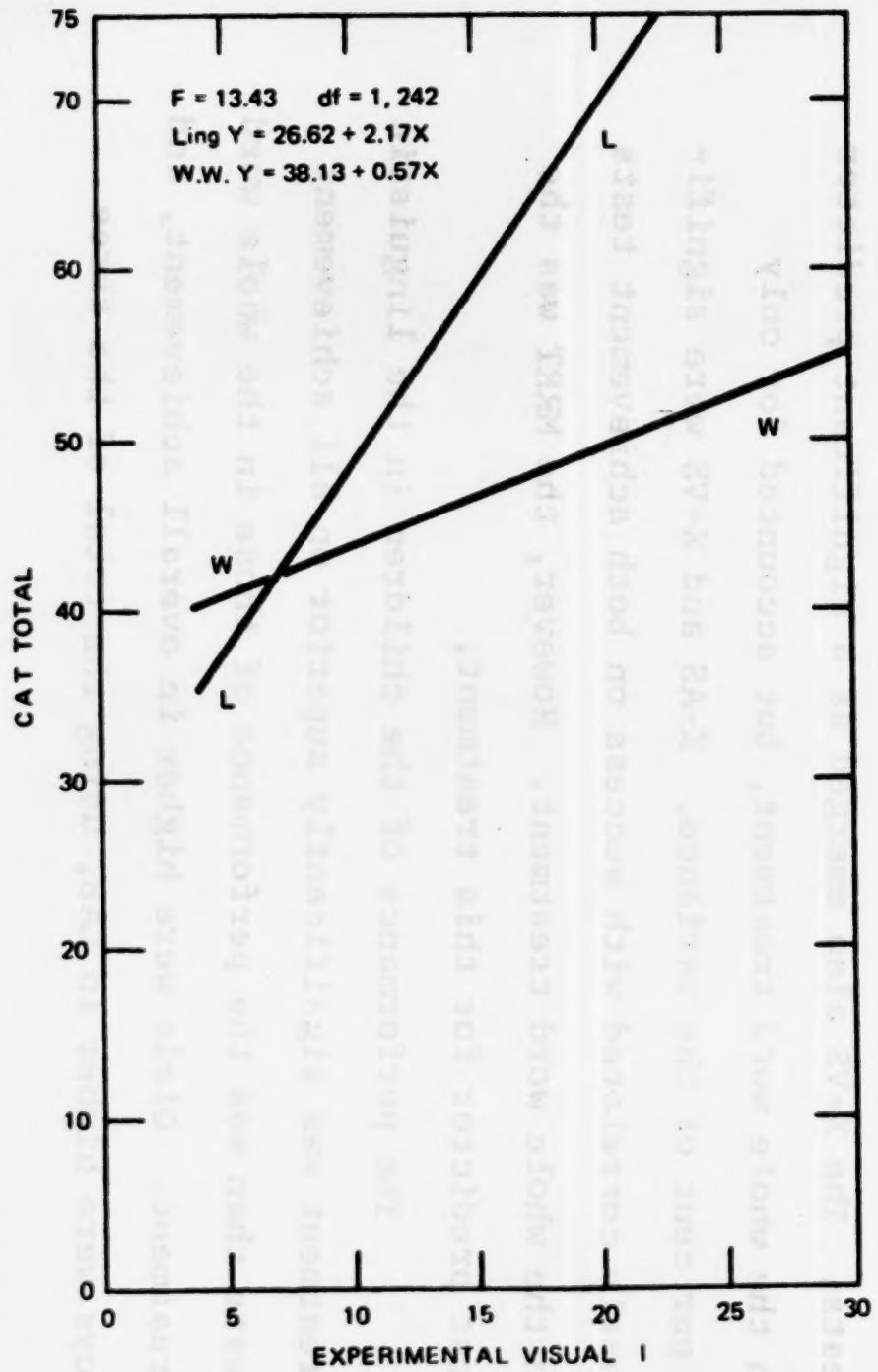
The major objective of this investigation, to field test an interactional hypothesis of beginning reading treatments and pupil sequencing aptitudes, was pursued by testing the following hypothesis.

> Children high in sequencing ability will exhibit higher reading achievement and less LAB in a whole word method than in a linguistic method. Conversely, children low in sequencing ability will exhibit higher reading achievement and lower LAB in a linguistic method than in a whole word approach.

Significant interactions of the type previously described were found between the two treatments, but not in the direction hpothesized. The regression lines relating the ITPA-AS pretest and the two tests of reading achievement crossed within the range of the predictor. Children below a score of 15 on the ITPA-AS pretest did better on the average in the whole word treatment, while those with scores above 15 on the ITPA-AS did better on the average in the linguistic treatment.

Similar interactions were found with X-VS pretest and the reading achievement tests. High visual sequencing ability as measured by this instrument was more closely associated with high achievement scores in the linguistic treatment. In the whole word treatment, the correlation of the X-VS with the CAT total was .16; in the linguistic treatment the same correlation was .55. The regression lines associated with these correlations were shown to cross if results for both treatments are graphed on the same set of axes (see Figure 11).

Children high in sequencing ability, therefore, exhibited higher reading achievement in the linguistic treatment than in the whole word treatment. Children low in sequencing ability exhibited lower reading achievement in the linguistic treatment than in the whole word treatment. Further, sequencing ability was negatively correlated with LAB in the whole word treatment, but was not correlated



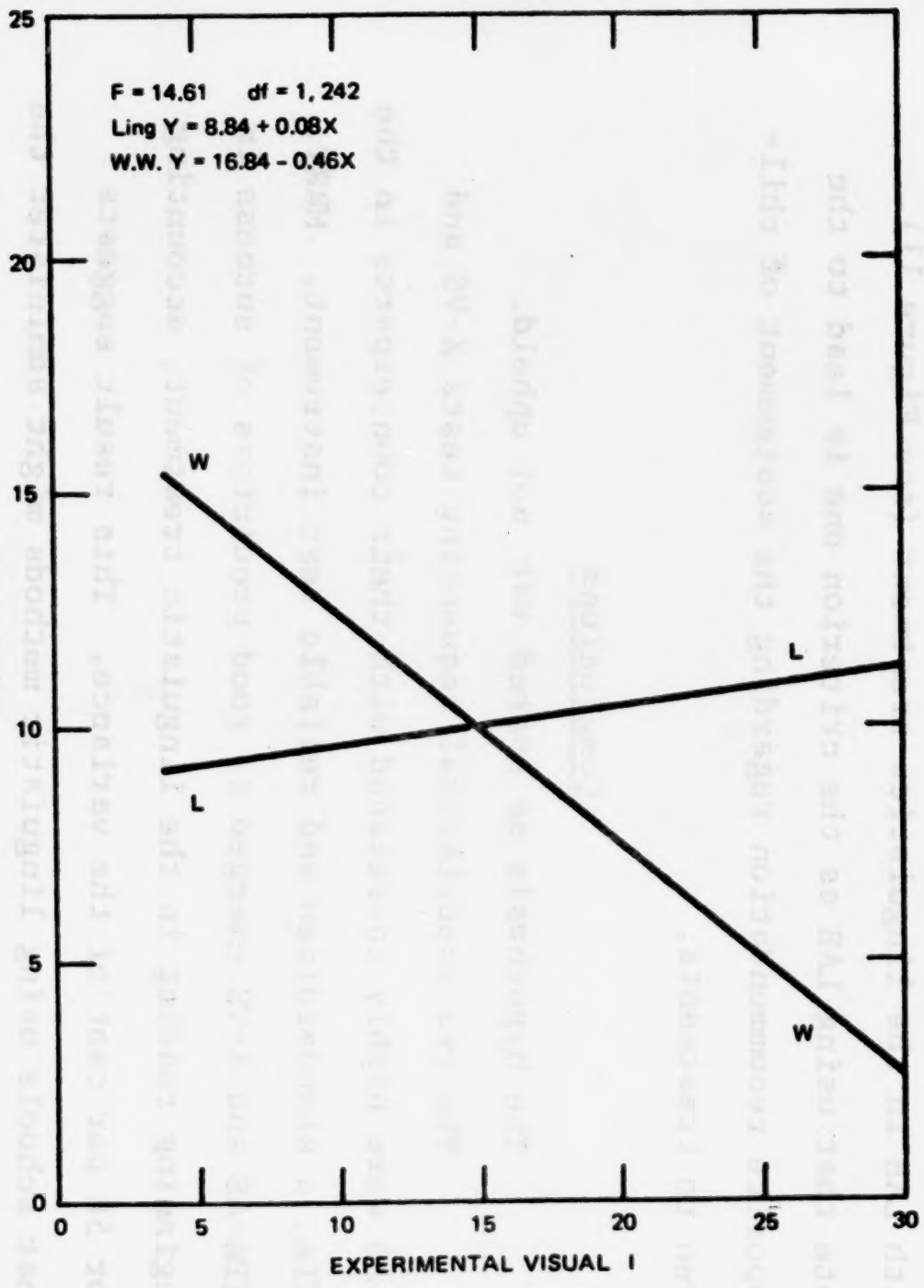


Fig. 9 --Regressions of CAT Total and Observation 2 on Experimental Visual 1 for Linguistic (L) and Whole Word (W.W.) Treatments.

with LAB in the linguistics treatment (see Figure 11). Note that using LAB as the criterion one is lead to the opposite recommendation regarding the assignment of children to treatments.

Conclusions

The hypothesis as stated was not upheld.

The two experimental sequencing tests X-VS and X-AS were highly correlated with their counterparts in the ITPA, a standardized and reliable test instrument. MRRT, ITPA-AS and X-VS emerged as good predictors of success in beginning reading in the linguistic treatment, accounting for 58 per cent of the variance. This result suggests that schools using linguistic methods might administer the ITPA-AS and the X-VS along with the standard readiness tests. The X-VS also emerged as a significant predictor in the whole word treatment, but accounted for only 6 per cent of the variance. X-AS and X-VS were significantly correlated with success on both achievement tests in the whole word treatment. However, the MRRT was the best predictor for this treatment.

The performance of the children in the linguistic treatment was significantly superior on all achievement tests than was the performance of those in the whole word treatment. Girls were higher in overall achievement, and boys were higher in LAB, using the total of the three

observations. No clear relationship was found between sequencing ability and general intelligence.

The present investigation suggests that the linguistic method of teaching reading is superior to the whole word method for most children, particularly higher sequencing ability children. Below a certain level of sequencing ability a child could be placed in a whole word method to maximize his chances of success. The two methods do not differ significantly at this end of the ability continuum structure. However, an alternate hypothesis using LAB as a criteria might be to place children low in sequencing ability in a linguistic treatment to minimize his LAB.

Discussion

The following discussion will consider seven topics: (a) the interaction of reading methods and sequencing ability; (b) sequencing tests as predictors of reading achievement; (c) the relation between LAB and reading achievement; (d) the relation between LAB and sequencing predictors; (e) some educational implications of this study; (f) suggestions for further research; and (g) limitations of study.

The Interaction of Reading Methods and Sequencing Ability

The correlations between both auditory and visual sequencing ability and achievement were quite high in the

linguistic treatment. Linguistic methods are analytic in nature. A child in the linguistic method is required to hold consonants and consonant sounds (e.g., c, b, d) and small graphemes (e.g., -at, -ot, -ut) in short-term memory and assemble them as needed. This activity may require sequencing ability to a greater degree than is required by learning whole words. The whole word treatment had a significantly lower positive correlation between sequencing ability and achievement than did the linguistic treatment.

Sequencing Tests as Predictors of Reading Achievement

This study appears to justify the use of sequencing ability as a predictor of success in beginning reading. The Experimental and ITPA intermodal correlations were high at pretest; the correlations of all pairs of sequencing posttests were above significance (.16) in both treatments. This indicates that sequencing ability seems to be a relatively coherent and stable characteristic. Further, X-VS seems to be a more valid predictor of reading achievement than is the ITPA-VS. The pattern of cross-modal correlations in both pretests and posttests requires further research. However, these data indicate that visual and auditory sequencing ability are closely related, not

necessarily exclusive. This study contributes to the validation of sequencing ability as a construct of interest in research on reading.

Learning Avoidance Behavior and Achievement

Observation 1 (LAB) was negatively related to all criterion measures in the linguistic treatment. This finding would indicate that to succeed in the linguistics group a pupil needs to be relatively low in LAB. Children in the whole word treatment scoring higher in LAB on Observation 1 did not have a tendency toward low achievement. In part this may be explained by the fact that close attention is required to analyze and put together graphemes and consonants, as in the linguistic method. The whole word method may tolerate a higher level of LAB, since it emphasizes more global associative and memory skills rather than drill on minute details, as required by a linguistic method.

Other Predictors and LAB

In the whole word treatment, pretest sequencing ability is correlated with LAB in the posttests. This result suggests that while a pupil may not need sequencing ability to achieve in the whole word treatment to the same extent that it is needed in the linguistic treatment, higher visual sequencing ability may aid a pupil in the whole word treatment to have less LAB.

Visual sequencing ability at pretest was not correlated with LAB on the second and third observations in the linguistic treatment. The linguistic method may develop in some children the kind of close attention it requires, and thus the ability to sequence visually is only slightly positively correlated with future LAB.

Educational Implications

The MRRT, ITPA-AS, and X-VS are good predictors of success for the linguistic treatment. This study suggests that schools using linguistic methods of teaching beginning reading might administer the ITPA-AS and the X-VS along with a reading readiness test. The two sequencing tests are individually administered. The time requirement for each child is about twenty minutes. The auditory sequencing requires the repetition of numbers; the visual sequencing requires the placement of cut-out wooden letters in a predetermined order. In this sample, above the raw score of 15 on the auditory test and above the score of 8 on the visual sequencing test, children can be expected to achieve well in a linguistic method. For pupils scoring below 15 on the ITPA-AS and below 8 on the X-VS, a whole word program or some such modification might be considered. Also, other deviances, e.g., reversals, upside-downs, that are noticed during the administration of the X-VS may be given attention in a remedial program.

It is important in our present stages of technology and development of reading programs that educators take notice of individual differences and make plans accordingly. The intention should not be to make all children fit a given program, but rather, to design programs to fit the diverse needs and existing abilities of children. School boards must be encouraged to purchase materials representing several methods of reading from which teachers can select according to the needs of their children.

Future Research

When the study began, there was a greater correlation between auditory and visual sequencing in the linguistic treatment than in the whole word treatment. This may be accounted for by the fact that the subjects were not randomly assigned to treatments, or by differences in Kindergarten programs. Kindergarten teachers in those schools where linguistic methods were used may prepare children for the first-grade program by providing some linguistic or sequencing training.

Both treatment groups had significant correlations between all of the sequencing tests at posttest. It appears that both treatments may act to integrate auditory and visual sequencing ability. This integration process needs further research to yield useful information.

The sequencing variables considered in this study seem closely associated with the skills required in linguistic methods. An investigation of the more global and associative memory skills required in the whole word methods might reveal ATI patterns similar to the pattern of short-term memory ATI found in the present study. The findings for MRRT as a predictor may provide some clues as to ability valuables of particular interest for whole word treatments.

The population for this study was relatively homogeneous, i.e., Caucasian middle class. A study of the sequencing abilities of other cultural groups would be of value. It has been hypothesized that ghetto children might have better chances to succeed if they are trained in linguistic methods, which move slowly and exactly. The results of the present study suggest that linguistic training may be a good treatment only if a child's sequencing ability is above a certain level.

Limitations

Teacher differences between treatments could not be controlled. Although the average age and average years of using the materials was the same between treatments, the average years of teaching experience was greater for the linguistic treatment ($\bar{X}$ = 11.50) than the whole word treatment ($\bar{X}$ = 7.57).

Non-random assignment of students to treatments limits the generalizations that can be made from the study. In the pilot studies, students were randomly assigned to treatment groups, but the N was necessarily small. The present study sought to compensate for the small N, but random assignment had to be sacrificed in the multiple classroom setting.

The lack of certain measurements in the present study limited our understanding of the obtained relationships between sequencing abilities, LAB, and achievement. Measures of memory span, anxiety, and general ability might have contributed useful information toward this understanding.

Further statistical analysis of the data of the present study might shed light on conclusions and hypotheses worthy of investigation. Such analyses are planned but have not been included in the present report.

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APPENDIX A

MEASURING INSTRUMENTS

The Illinois Test of Psycholinguistic Abilities--
Individual

An Experimental Visual-Motor Sequencing Test of Letters--
Individual

An Experimental Auditory Sequencing Test of Sounds--
Individual

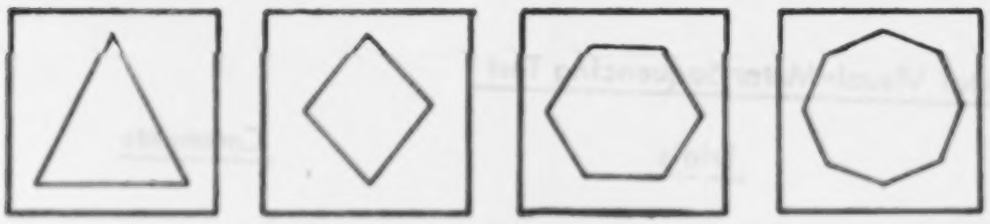
Classroom Observers Learning Avoidance Check Sheet--
Individual

Reading Test A Linguistic Approach--
Group

The Illinois Test of Psycholinguistic Ability (ITPA)

Of the nine ITPA subtests, only the Visual-Motor Sequencing (ITPA 8) and the Auditory-Vocal Sequencing (ITPA 9) were given.

The Visual-Motor Sequencing test requires the child to reproduce from memory a given sequence of cards containing pictures of objects and of geometrical figures. The examiner places the cards, in the predetermined sequence, in a white plastic tray. The child is asked to look at the cards. The examiner then mixes the cards the child saw. The child is then asked to reproduce the original sequence; he is given a second chance if he fails to reproduce the given sequence on the first trial. Success on the second trial is scored as one point. The test is terminated by the examiner if the child fails to reproduce the sequence of any item in two trials. The items are of increasing difficulty, one new card being added with each succeeding item.



ITPA VISUAL SEQUENCING TEST

The Auditory-Vocal Sequencing subtest requires the child to repeat numbers in the same order that the examiner says them. The scoring procedures are the same as those for the Visual-Motor Sequencing subtest.

Experimental Sequencing Test

Cut out orange wooden lower case letters were used for this test. The examiner placed the letters on a white plastic rectangle tray. The order of the letter sequences is given on the following page. The child was asked to look at the first sequence and try to place the letters back in the tray in the same order so they would look just the same. Two trials were allowed for each sequence. If the child failed on the second trial the test was stopped. Two points were scored for a correct answer on the first trial and one point on the second trial. Any irregularities such as reversals, upside down letters, right to left tendencies, verbalizations, or emotional responses were recorded. (A child was not stopped for these irregularities; they were recorded for additional information to be examined in light of the child's progress.)

Experimental Visual-Motor Sequencing Test

		Trials		Comments
1.	s			
2.	st			
3.	sts			
4.	sst			
5.	sto			
6.	osdd			
7.	ssgd			
8.	dgdc			
9.	tcdg			
10.	gdcy			
11.	ctcdo			
12.	dtgcg			
13.	dcytd			
14.	tjgddc			
15.	tygdjc			

Student's Name_____ Age_____

Examiner_____ School_____

Experimental Auditory Sequencing Test

		Trials		Comments
1.	B	___	___	
2.	BT	___	___	
3.	BTB	___	___	
4.	TTB	___	___	
5.	BTP	___	___	
6.	WTBB	___	___	
7.	BTWB	___	___	
8.	WTBB	___	___	
9.	TATW	___	___	
10.	BATB	___	___	
11.	WATB	___	___	
12.	TATDW	___	___	
13.	WWTBD	___	___	
14.	TWTBD	___	___	
15.	WATDW	___	___	
16.	TTDWWN	___	___	
17.	NWNTTD	___	___	

The experimental auditory test was given by an examiner pronouncing the sounds slowly and evenly; e.g. 1. Ba, 2. Ba, Ta, 3. Ba, Ta, Ba, etc. The child had two chances to repeat the same sounds in the same order. A correct answer on the first trial was scored two points and one point on the second trial.

Classroom Observation

Observers were instructed to watch each child for five minutes during the reading period. The observation was taken during a time when the child was engaged in the reading process with the teacher. The five minutes were to be treated as five one-minute sections. A category could not have more than five entries during one observation, but any one minute could have one to nineteen categories checked. The observer had to distinctly observe the behavior, he could not merely "think" it happened. Operational definitions were discussed in training sessions and each observer was paired with the trainer for ten observations.

	Student Name _____ Tester _____ School _____	Date	Time	Date	Time	Date	Time
1.	Hands twisting or clenching						
2.	Feet or legs twisting around chair legs						
3.	Tapping with feet or hands						
4.	Tapping with pencil or other items						
5.	Rocking body or head						
6.	Tipping chair or desk						
7.	Falling off chair						
8.	Irrelevant movement from chair such as sharpening pencil that doesn't need sharpening						
9.	Distracting neighbors						
10.	Making nonsense sounds: humming, sing-song, talk to self						
11.	Continued eye attention away from work--daydreaming						
12.	Facial grimace; squinting or blinking eyes						
13.	Yawning, coughing, sighing						
14.	Nose picking						
15.	Thumb sucking						
16.	Scratching						
17.	Playing with hair; twisting, etc.						
18.	Obscuring face with hands or hair						
19.	Complaint of physical ailments; stomachache, headache, etc.						

PALO ALTO UNIFIED SCHOOL DISTRICT
Inter-Office Memorandum

100

To: Classroom Teachers Date: 29 January 70

From: Jane Stallings

Subject: Reading Project

There are some children in every room who are easily distracted, generally wiggly, and over-anxious. You probably have some in your room. Some of the behaviors we would use to describe "over-anxious" are: stuttering, nail biting, finger sucking, hair twisting, clothes twisting, unduly shy, worried when called upon. "Generally wiggly" would be described as quite a lot of body movement such as: toe taping, scooting up and down in the chair, stretching, irrelevant movement from the chair, swinging legs. Children who are "easily distracted" would usually have a short attention span, eyes often away from their work, they often talk to other children, they must be prodded to finish their work.

Please score your children on the 1-5 scale that is included here. One score sheet is for these behaviors evidenced during reading and the other score sheet is for these behaviors evidenced during other times of the day.

This score form will help us in checking our classroom observations with your knowledge of the children.

It will help if you will return these forms to the Research Department within the next two days. Thank you again for your help. We will discuss the results very soon.

Copies to:

SCHOOL

TEACHER

Would you please rate each child in your room Low, Medium or High, on the scale of 1-5, on the following behaviors that may be exhibited during reading period.

Name of Child	Easily Distracted					Generally Wiggly					Over Anxious				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1															
2															
3															
4															
5															
6															
7															
8															
9															
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23															
24															

APPENDIX B

ANALYSIS OF VARIANCE AND MULTIPLE REGRESSION

Table

13. Summary Table of Significance Values for Analysis of Variance

14. ITPA Visual Sequencing I

15. ITPA Auditory Sequencing I

16. Experimental Visual Sequencing I

17. Experimental Auditory Sequencing I

18. ITPA Visual Sequencing II

19. ITPA Auditory Sequencing II

20. Experimental Visual Sequencing II

21. Experimental Auditory Sequencing II

22. Observation I

23. Observation II

24. Observation Total

25. Observation III

26. CAT Vocabulary Total

27. CAT Reading Comprehension

28. CAT Total

29. RTLA 1, 2, 3

30. RTLA Total

31. Multiple Regressions

TABLE 13

Summary Table of Significance Values for Analysis of Variance

	Level of sig. = 0.05	Level of sig. = 0.01
Sex = S	F = 4.96; df = 1, 10	F = 10.0; df = 1, 10
Treatment = T	F = 4.96; df = 1, 10	F = 10.0; df = 1, 10
Class within treatment = C(T)	F = 1.83; df = 10, 222	F = 2.32; df = 10, 222
Sex by treatment = ST	F = 4.96; df = 1, 10	F = 10.0; df = 1, 10
Sex by class within treatment = Sc(T)	F = 1.83; df = 10, 222	F = 2.32; df = 10, 222

df = 1, 10 means 1 is for numerator and 10 is for denominator

TABLE 14. ANALYSIS OF VARIANCE
ITPA Visual Sequencing I

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	20.81	1	20.81	2.17
Treatment	C(T)	160.97	1	160.97	2.89
Class(Treatment)	R(STC)	555.74	10	55.57	3.24 **
Sex(Treatment)	SC(T)	27.41	1	27.41	2.89
Sex x Class(T)	R(STC)	95.36	10	9.54	0.55
R (STC)		3804.55	222	17.14	

Legend:
S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	14.06	3.10	14.20	3.97	14.12	3.39
2	13.00	4.52	12.90	4.16	12.95	4.24
3	12.78	2.68	14.40	5.08	13.63	4.10
4	17.43	5.41	16.36	4.82	16.78	4.93
5	12.92	3.63	13.;9	5.84	13.00	4.70
6	16.09	3.08	15.85	4.06	15.96	3.57
TOTAL	14.20	3.91	14.52	4.69	14.36	4.31
B. WHOLE WORD						
Class 1	14.56	3.17	12.93	5.76	13.56	4.89
2	13.83	3.19	9.82	3.60	11.24	3.90
3	13.14	2.61	14.00	1.60	13.68	2.00
4	13.63	5.07	14.33	4.69	14.00	4.73
5	14.50	4.17	13.22	4.09	13.90	4.07
6	10.77	4.30	8.43	2.76	9.95	3.93
TOTAL	13.21	4.03	12.32	4.44	12.73	4.26
GRAND TOTAL	13.75	3.98	13.45	4.68	13.60	4.35

TABLE 15. ANALYSIS OF VARIANCE
ITPA Auditory Sequencing I

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	66.25	1	66.25	2.48
Treatment	C(T)	10.25	1	10.25	0.43
Class(Treatment)	R(STC)	238.37	10	23.84	0.61
Sex(Treatment)	SC(T)	56.37	1	56.37	2.11
Sex x Class(T)	R(STC)	266.93	10	26.69	0.69
R (STC)		8626.69	222	38.85	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
A. LINGUISTIC						
Class 1	23.20	4.81	24.50	4.86	23.72	4.77
2	26.82	7.25	22.09	2.66	24.46	5.85
3	23.33	7.92	25.00	6.09	24.21	6.87
4	25.57	7.25	26.73	7.80	26.28	7.40
5	26.00	6.71	22.91	6.07	24.52	6.47
6	23.73	4.54	26.92	6.81	25.46	5.99
TOTAL	24.69	6.26	24.76	6.04	24.73	6.13
B. WHOLE WORD						
Class 1	26.22	7.51	23.64	5.68	24.65	6.42
2	26.50	4.89	26.09	5.89	26.24	5.40
3	26.71	10.19	23.42	3.87	24.63	6.82
4	23.75	4.30	21.33	4.69	22.47	4.54
5	23.90	5.11	23.22	7.03	23.58	5.93
6	24.92	7.79	22.00	7.23	23.90	7.55
TOTAL	25.19	6.73	23.45	5.65	24.25	6.21
GRAND TOTAL	24.92	6.45	24.13	5.87	24.50	6.16

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TABLE 16. ANALYSIS OF VARIANCE
Experimental Visual Sequencing I

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	0.61	1	0.61	0.03
Treatment	C(T)	3.78	1	3.78	0.03
Class(Treatment)	R(STC)	1241.97	10	124.19	4.56 **
Sex(Treatment)	SC(T)	84.28	1	84.28	3.84
Sex x Class(T)	R(STC)	219.30	10	21.93	0.80
R (STC)		6043.37	222	27.22	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	17.20	4.89	17.10	5.65	17.16	5.09
2	11.00	6.62	11.64	5.12	11.32	5.79
3	16.11	7.17	19.80	4.89	.8.05	6.20
4	13.86	6.99	15.82	5.81	15.06	6.17
5	13.50	4.32	13.64	4.39	13.57	4.25
6	18.18	5.04	18.46	3.95	18.33	4.38
TOTAL	15.12	6.05	16.08	5.53	15.60	5.79
B. WHOLE WORD						
Class 1	14.89	5.33	14.43	6.07	14.61	5.67
2	21.33	4.18	15.18	5.90	17.35	6.03
3	14.43	5.86	16.58	3.85	15.79	4.65
4	17.38	6.21	16.56	3.84	16.94	4.94
5	18.10	6.12	16.44	3.82	17.32	5.46
6	12.46	3.15	11.57	3.78	12.15	3.31
TOTAL	15.94	5.66	15.26	5.02	15.57	5.31
GRAND TOTAL	15.49	5.87	15.68	5.28	15.59	5.56

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TABLE 17. ANALYSIS OF VARIANCE
Experimental Auditory Sequencing I

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	237.68	1	237.68	10.02 **
Treatment	C(T)	12.43	1	12.43	0.19
Class(Treatment)	R(STC)	664.81	10	66.48	1.79
Sex(Treatment)	SC(T)	8.68	1	8.68	0.37
Sex x Class(T)	R(STC)	237.12	10	23.71	0.64
R (STC)		8225.00	222	37.05	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	13.80	6.61	16.10	5.80	14.72	6.28
2	16.73	7.79	13.36	4.59	15.05	6.47
3	17.89	6.55	16.60	5.52	17.21	5.89
4	17.43	8.94	14.55	4.99	15.67	6.70
5	20.25	7.48	15.82	8.69	18.13	8.22
6	19.82	6.97	19.69	5.89	19.75	6.26
TOTAL	17.46	7.40	16.12	6.19	16.78	6.82
B. WHOLE WORD						
Class 1	18.22	3.35	18.00	4.13	18.09	3.77
2	16.83	6.34	16.36	5.08	16.53	5.36
3	19.85	6.94	15.58	5.23	17.16	6.10
4	16.62	7.54	13.00	5.96	14.71	6.79
5	18.30	4.74	16.22	4.82	17.32	4.76
6	15.62	5.32	11.86	4.14	14.30	5.16
TOTAL	17.42	5.59	15.57	5.13	16.42	5.40
GRAND TOTAL	17.44	6.62	15.85	5.68	16.61	6.19

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TABLE 18 ANALYSIS OF VARIANCE

ITPA Visual Sequencing II

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	1.48	1	1.48	0.11
Treatment	C(T)	156.80	1	156.80	2.23
Class(Treatment)	R(STC)	700.71	10	70.07	4.14 **
Sex(Treatment)	SC(T)	3.07	1	3.07	0.23
Sex x Class(T)	R(STC)	130.96	10	13.10	0.77
R (STC)		3749.63	222	16.89	

Legend:
S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	9.07	4.80	8.90	3.07	9.00	4.12
2	8.64	5.07	10.82	4.67	9.73	4.88
3	11.78	4.18	12.70	4.69	12.26	4.36
4	10.00	1.83	8.64	4.61	9.17	3.76
5	13.75	3.82	13.36	4.57	13.57	4.10
6	13.45	2.88	12.69	3.88	13.04	3.41
TOTAL	11.08	4.45	11.24	4.53	11.16	4.47
B. WHOLE WORD						
Class 1	13.67	4.36	11.79	4.37	12.52	4.37
2	15.83	4.36	14.91	2.66	15.24	3.25
3	13.86	4.53	14.42	4.23	14.21	4.22
4	10.63	2.07	13.44	5.05	12.12	4.09
5	13.30	5.50	10.44	4.28	11.95	5.04
6	10.62	2.81	10.57	2.30	10.60	2.58
TOTAL	12.66	4.25	12.76	4.21	12.71	4.21
GRAND TOTAL	11.79	4.41	11.98	4.43	11.88	4.41

TABLE 19. ANALYSIS OF VARIANCE
ITPA Auditory Sequencing II

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	15.81	1	15.81	0.66
Treatment	C(T)	334.62	1	334.62	1.73
Class(Treatment)	R(STC)	1927.50	10	192.75	5.60 **
Sex(Treatment)	SC(T)	8.43	1	8.43	0.35
Sex x Class(T)	R(STC)	237.66	10	23.77	0.69
R (STC)		7637.62	222	34.40	

Legend:
S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	25.20	5.98	25.50	4.97	25.32	5.49
2	25.45	7.66	20.91	4.09	23.18	6.43
3	23.22	7.60	26.20	7.16	24.79	7.32
4	25.57	8.62	24.36	7.47	24.83	7.71
5	22.58	6.05	20.00	4.20	21.35	5.30
6	26.00	5.46	25.69	5.65	25.83	5.44
TOTAL	24.66	6.62	23.77	6.02	24.21	6.31
B. WHOLE WORD						
Class 1	22.89	5.62	21.64	5.02	22.13	5.17
2	25.67	7.00	26.27	5.85	26.06	6.07
3	22.43	9.16	24.33	4.36	23.63	6.36
4	15.13	5.03	11.67	3.87	13.29	4.66
5	22.30	3.09	22.78	7.76	22.53	3.86
6	23.50	5.82	23.86	4.53	21.92	6.43
TOTAL	21.89	6.43	21.95	6.48	21.92	6.43
GRAND TOTAL	23.42	6.65	22.89	6.29	23.14	6.46

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TABLE 20. ANALYSIS OF VARIANCE

Experimental Visual Sequencing II

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	0.03	1	0.03	0.00
Treatment	C(T)	4.81	1	4.81	0.12
Class(Treatment)	R(STC)	388.23	10	38.82	2.33 **
Sex(Treatment)	SC(T)	0.11	1	0.11	0.01
Sex x Class(T)	R(STC)	90.83	10	9.08	0.54
R (STC)		3696.85	222	16.65	

Legend:
S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	12.27	3.49	10.70	1.49	11.64	2.93
2	13.18	1.83	13.64	4.63	13.41	3.45
3	14.11	5.90	14.90	6.74	14.53	6.20
4	12.57	4.16	11.64	4.50	12.00	4.27
5	14.33	2.42	16.45	4.76	15.35	3.80
6	15.73	4.20	15.00	3.46	15.33	3.75
TOTAL	13.68	3.80	13.79	4.76	13.73	4.30
B. WHOLE WORD						
Class 1	13.78	3.83	13.21	5.07	13.44	4.54
2	15.33	4.18	13.91	5.94	14.41	5.29
3	11.43	4.58	13.08	3.65	12.47	3.98
4	13.75	2.12	13.22	2.95	13.47	2.53
5	15.00	3.86	13.89	3.06	14.47	3.45
6	11.46	2.93	13.00	3.51	12.00	3.15
TOTAL	13.30	3.73	13.39	4.17	13.35	3.96
GRAND TOTAL	13.51	3.76	13.59	4.47	13.55	4.14

TABLE 21. ANALYSIS OF VARIANCE
Experimental Auditory Sequencing II

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	39.71	1	39.71	1.39
Treatment	C(T)	10.67	1	10.67	0.07
Class(Treatment)	R(STC)	1372.19	10	137.22	4.27 **
Sex(Treatment)	SC(T)	27.27	1	27.27	0.95
Sex x Class(T)	R(STC)	285.30	10	28.53	0.88
R (STC)		7134.28	222	32.13	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	14.27	4.23	16.40	5.83	15.12	4.94
2	16.24	7.85	12.27	3.58	14.46	6.36
3	17.78	7.84	14.90	5.11	16.26	6.52
4	16.00	7.51	15.82	9.68	15.89	8.66
5	12.75	4.96	11.73	4.82	12.26	4.81
6	16.82	4.79	14.08	5.19	15.33	5.10
TOTAL	15.49	6.11	14.15	6.02	14.82	6.08
B. WHOLE WORD						
Class 1	11.56	4.48	14.43	5.18	13.30	5.02
2	22.50	4.89	21.09	5.15	21.59	4.95
3	15.57	5.97	18.58	5.25	17.47	5.56
4	14.50	5.81	12.33	5.55	13.35	5.60
5	15.20	4.42	13.00	6.18	14.16	5.29
6	13.38	4.94	12.43	4.23	13.05	4.62
TOTAL	14.91	5.69	15.68	6.09	15.32	5.89
GRAND TOTAL	15.23	5.91	14.89	6.08	15.05	5.98

TABLE 22. ANALYSIS OF VARIANCE

Observation I

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	50.92	1	50.92	4.11
Treatment	C(T)	38.74	1	38.74	0.18
Class(Treatment)	R(STC)	2039.64	10	203.96	10.68 **
Sex(Treatment)	SC(T)	8.21	1	8.21	0.66
Sex x Class(T)	R(STC)	123.76	10	12.38	0.65
R (STC)		4239.26	222	19.09	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	11.33	5.92	11.50	7.44	11.40	6.42
2	9.09	3.99	13.82	5.90	11.46	5.47
3	4.22	1.72	3.70	0.95	3.95	1.35
4	5.29	1.98	4.91	0.94	5.06	1.39
5	10.92	4.78	11.55	6.92	11.22	5.77
6	9.00	4.56	12.23	3.68	10.75	4.34
TOTAL	8.85	4.97	9.76	6.15	9.31	5.59
B. WHOLE WORD						
Class 1	3.56	4.39	4.00	2.77	3.83	3.41
2	9.33	4.59	9.36	4.25	9.35	4.23
3	10.43	3.91	11.50	5.23	11.11	4.70
4	8.00	3.89	9.78	4.12	8.94	3.99
5	10.40	4.81	10.89	4.48	10.63	4.54
6	5.46	1.39	5.00	1.41	5.30	1.38
TOTAL	7.55	4.49	8.36	4.86	7.98	4.69
GRAND TOTAL	8.26	4.79	9.08	5.58	8.68	5.22

TABLE 23. ANALYSIS OF VARIANCE
OBSERVATION II

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	42.40	1	42.40	3.16
Treatment	C(T)	37.97	1	37.97	0.88
Class(Treatment)	R(STC)	427.66	10	42.77	2.04 *
Sex(Treatment)	SC(T)	0.35	1	0.35	0.02
Sex x Class(T)	R(STC)	133.78	10	13.38	0.63
R (STC)		4652.63	222	20.95	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	9.73	3.43	10.40	3.63	10.00	3.45
2	9.91	3.65	9.91	2.63	9.91	3.10
3	10.11	3.66	9.80	5.09	9.95	4.35
4	11.29	6.05	10.55	4.34	10.83	4.91
5	10.50	6.59	12.18	8.24	11.30	7.30
6	5.73	2.15	9.08	5.16	7.54	4.33
TOTAL	9.45	4.58	10.29	5.07	9.87	4.83
B. WHOLE WORD						
Class 1	7.78	2.11	9.00	3.68	8.52	3.16
2	8.00	3.69	11.82	3.60	10.47	3.99
3	12.43	5.38	10.50	3.00	11.21	4.01
4	10.13	2.95	10.56	4.93	10.35	3.99
5	12.00	4.45	12.78	2.95	12.37	3.73
6	11.31	5.59	12.57	7.50	11.75	6.16
TOTAL	10.43	4.50	10.97	4.29	10.72	4.37
GRAND TOTAL	9.89	4.55	10.62	4.70	10.27	4.64

TABLE 24. ANALYSIS OF VARIANCE
Observation Total

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	365.31	1	365.31	12.42 **
Treatment	C(T)	1.06	1	1.06	0.00
Class(Treatment)	R(STC)	3662.63	10	366.26	5.41 **
Sex(Treatment)	SC(T)	2.00	1	2.00	0.06
Sex x Class(T)	R(STC)	294.12	10	29.41	0.43
R (STC)		15,021.88	222	67.66	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	26.80	8.23	27.50	10.06	27.08	8.81
2	24.82	5.84	31.18	9.36	28.00	8.28
3	24.67	6.70	24.70	6.73	24.68	6.53
4	26.86	5.87	27.18	5.88	27.06	5.70
5	30.50	9.91	32.36	12.47	31.39	10.99
6	24.18	9.05	31.08	8.22	27.92	9.11
TOTAL	26.42	7.98	29.15	9.10	27.79	8.64
B. WHOLE WORD						
Class 1	15.67	5.83	20.36	6.01	18.52	6.26
2	24.67	5.28	27.36	8.81	26.41	7.68
3	31.71	8.71	31.75	7.11	31.74	7.50
4	27.75	11.97	30.44	8.66	29.18	10.11
5	32.40	9.00	34.11	7.11	33.21	7.99
6	27.69	6.82	29.71	8.08	28.40	7.14
TOTAL	26.74	9.61	28.32	8.68	27.59	9.11
GRAND TOTAL	26.56	8.71	28.75	8.87	27.70	8.85

TABLE 25. ANALYSIS OF VARIANCE

Observation III

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	29.92	1	29.92	4.63
Treatment	C(T)	1.56	1	1.56	0.01
Class(Treatment)	R(STC)	969.75	10	96.98	6.91 **
Sex(Treatment)	SC(T)	0.63	1	0.63	0.09
Sex x Class(T)	R(STC)	64.64	10	6.46	0.46
R (STC)		3115.51	222	14.03	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	5.73	2.91	5.60	1.84	5.68	2.49
2	5.82	2.68	7.45	4.68	6.64	3.81
3	10.33	3.84	11.20	3.52	10.79	3.60
4	10.29	3.30	11.73	4.52	11.17	4.05
5	9.08	3.60	8.64	5.71	8.87	4.63
6	9.45	4.99	9.77	3.75	9.63	4.26
TOTAL	8.12	3.99	9.11	4.54	8.61	4.29
B. WHOLE WORD						
Class 1	4.33	1.58	7.36	3.56	6.17	3.27
2	7.33	3.08	6.18	2.93	6.59	2.94
3	8.86	4.06	9.75	5.26	9.42	4.75
4	9.63	6.14	10.11	3.14	9.88	4.64
5	10.00	2.79	10.44	2.51	10.21	2.59
6	10.92	2.06	12.14	3.02	11.35	2.43
TOTAL	8.76	3.98	9.00	3.99	8.89	3.97
GRAND TOTAL	8.41	3.98	9.05	4.27	8.74	4.13

TABLE 26. ANALYSIS OF VARIANCE
CAT Vocabulary Total

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	938.18	1	938.18	8.81 *
Treatment	C(T)	3403.62	1	3408.62	5.58 *
Class(Treatment)	R(STC)	6057.43	10	605.74	4.61 **
Sex(Treatment)	SC(T)	571.31	1	571.31	5.37 *
Sex x Class(T)	R(STC)	1064.49	10	106.45	0.81
R (STC)		29,229.62	222	131.66	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	48.47	5.91	50.20	10.52	49.16	7.91
2	47.36	11.25	40.18	10.32	43.77	11.15
3	48.33	15.43	52.60	12.89	50.58	13.92
4	53.29	15.45	48.82	19.23	50.56	17.51
5	48.75	12.27	50.82	13.03	49.74	12.40
6	65.09	7.99	63.38	7.84	64.17	7.78
TOTAL	51.65	12.47	51.36	14.17	51.50	13.30
B. WHOLE WORD						
Class 1	42.00	14.22	41.71	14.72	41.83	14.20
2	58.50	10.13	42.82	10.87	48.35	12.87
3	48.14	11.63	39.75	9.44	42.84	10.81
4	48.38	10.29	42.33	9.82	45.18	10.21
5	43.60	11.80	37.78	4.52	40.84	9.37
6	43.62	7.73	37.00	9.85	41.30	8.88
TOTAL	46.34	11.55	40.52	10.53	43.20	11.35
GRAND TOTAL	49.26	12.30	46.11	13.63	47.62	13.08

TABLE 27. ANALYSIS OF VARIANCE

CAT Reading Comprehension

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	38.83	1	38.83	2.81
Treatment	C(T)	327.86	1	327.86	3.56
Class(Treatment)	R(STC)	920.07	10	92.01	7.82 **
Sex(Treatment)	SC(T)	17.25	1	17.25	1.25
Sex x Class(T)	R(STC)	138.29	10	13.83	1.17
R (STC)		2610.63	222	11.76	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	2.53	1.41	3.40	3.37	2.88	2.37
2	3.82	4.26	1.64	4.48	2.73	4.41
3	6.44	3.54	7.40	3.81	6.95	3.61
4	6.14	3.72	4.91	4.16	5.39	3.93
5	2.25	2.86	3.36	4.95	2.78	3.94
6	10.00	5.29	8.85	3.36	9.38	4.29
TOTAL	4.89	4.44	5.03	4.67	4.96	4.54
B. WHOLE WORD						
Class 1	3.44	4.59	3.00	4.76	3.17	4.59
2	7.00	2.97	2.00	2.57	3.76	3.60
3	1.14	1.21	1.42	1.73	1.32	1.53
4	4.00	2.00	3.22	3.11	3.59	2.60
5	3.10	3.38	1.00	1.22	2.11	2.75
6	1.54	1.33	1.43	0.98	1.50	1.19
TOTAL	3.09	3.19	2.08	2.95	2.55	3.09
GRAND TOTAL	4.08	4.02	3.60	4.19	3.83	4.10

TABLE 28. ANALYSIS OF VARIANCE

CAT Total

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	1362.94	1	1362.94	7.48 *
Treatment	C(T)	5853.00	1	5853.00	5.34 *
Class(Treatment)	R(STC)	10,952.20	10	1095.22	5.47 **
Sex(Treatment)	SC(T)	783.44	1	783.44	4.30
Sex x Class(T)	R(STC)	1821.70	10	182.17	0.90
R (STC)		44,448.31	222	200.21	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	51.00	6.13	53.60	12.89	52.04	9.27
2	51.18	15.28	41.82	14.34	46.50	15.24
3	54.78	18.03	60.00	16.39	57.53	16.91
4	59.43	18.72	53.73	22.55	55.95	20.76
5	51.00	14.29	54.18	17.65	52.52	15.70
6	75.18	13.06	72.23	10.72	73.58	11,68
TOTAL	56.55	16.09	56.39	18.18	56.47	17.11
B. WHOLE WORD						
Class 1	45.44	18.56	44.71	18.75	45.00	18.25
2	65.50	12.90	44.82	12.46	52.12	15.900
3	49.29	12.35	41.17	10.06	44.16	11.34
4	52.38	11.29	45.56	11.72	48.77	11.69
5	46.70	14.97	38.78	4.94	42.95	11.87
6	45.15	8.06	38.43	10.49	42.80	9.31
TOTAL	49.43	14.05	42.60	12.59	45.75	13.66
GRAND TOTAL	53.36	15.56	49.71	17.12	51.46	16.46

TABLE 29 ANALYSIS OF VARIANCE

RTLA 1, 2, 3

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	139.44	1	139.44	5.03 *
Treatment	C(T)	601.00	1	601.00	4.59
Class(Treatment)	R(STC)	1306.82	10	130.68	4.65 **
Sex(Treatment)	SC(T)	0.07	1	0.07	0.003
Sex x Class(T)	R(STC)	277.07	10	27.71	0.98
R (STC)		6237.31	222	28.09	

Legend:
S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	19.87	4.10	20.10	5.30	19.96	4.51
2	19.27	5.16	14.55	5.07	16.91	5.55
3	22.11	5.51	23.50	4.60	22.84	4.96
4	19.86	8.23	15.64	8.69	17.28	8.53
5	17.17	5.70	16.09	8.17	16.65	6.85
6	25.00	3.35	24.23	3.03	24.58	3.13
TOTAL	20.45	5.63	19.09	7.06	19.76	6.40
B. WHOLE WORD						
Class 1	17.11	6.13	14.93	5.33	15.78	5.62
2	22.00	3.41	16.36	6.41	18.35	6.08
3	15.71	2.21	13.83	3.90	14.53	3.44
4	18.00	5.68	16.56	3.91	17.24	4.72
5	16.30	5.56	17.33	3.32	16.79	4.54
6	15.00	3.72	15.71	5.28	15.25	4.20
TOTAL	16.94	4.97	15.65	4.81	16.24	4.91
GRAND TOTAL	18.87	5.60	17.42	6.29	18.12	6.00

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TABLE 30. ANALYSIS OF VARIANCE

RTLA Total

SOURCE OF VARIATION	ERROR TERM	SUM OF SQUARES	d.f.	MEAN SCORE	F
Sex	SC(T)	351.81	1	351.81	3.37
Treatment	C(T)	2066.81	1	2066.81	3.47
Class(Treatment)	R(STC)	5952.13	10	592.21	6.51 **
Sex(Treatment)	SC(T)	8.69	1	8.69	0.08
Sex x Class(T)	R(STC)	1042.43	10	104.24	1.14
R (STC)		20,273.94	222	91.32	

Legend: S= Sex
T= Treatment
C= Class
R= Population

TREATMENT	GIRLS		BOYS		TOTAL	
A. LINGUISTIC	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Class 1	24.27	6.18	25.70	7.66	24.84	6.69
2	25.55	12.63	17.00	10.10	21.27	11.96
3	29.44	9.72	32.70	9.53	31.16	9.50
4	26.86	14.80	19.55	14.79	22.39	14.81
5	19.67	10.34	19.73	14.26	19.70	12.08
6	39.00	8.84	37.69	7.85	38.29	8.16
TOTAL	27.12	11.58	25.65	13.2	26.38	12.40
B. WHOLE WORD						
Class 1	21.67	10.68	19.00	11.60	20.04	11.08
2	21.17	11.49	19.64	9.15	23.71	11.22
3	17.71	2.36	15.83	5.08	16.53	4.30
4	24.00	8.18	20.78	6.04	22.29	7.09
5	20.30	9.53	21.22	4.49	20.74	7.39
6	16.54	5.04	17.86	6.69	17.00	5.54
TOTAL	21.06	9.02	18.95	7.89	19.92	8.46
GRAND TOTAL	24.40	10.89	22.41	11.42	23.36	11.19

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TABLE

Multiple Regressions

	CAT Total						RTLA Total					
	Linguistic			Whole Word			Linguistic			Whole Word		
Variable entered	Multiple R	RSQ	F-value	Multiple R	RSQ	F-value	Multiple R	RSQ	F-value	Multiple R	RSQ	F-value
ITPA-AS-I	0.44	0.19	30.64**	0.13	0.02	1.85	0.14	0.02	2.65	0.09	0.01	0.91
X-VS-I	0.62	0.39	40.75**	0.21	0.04	3.25	0.23	0.06	4.77*	0.14	0.02	1.25
MRRT Total	0.71	0.51	30.76**	0.48	0.23	27.45**	0.25	0.06	1.02	0.17	0.03	1.26
Observation	0.72	0.51	1.62	0.48	0.23	0.04	0.25	0.06	0.16	0.19	0.03	0.55

APPENDIX C

GRAPHS OF SELECTED INTERACTIONS

Figure

12. Regression of Observation 2 on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

13. Regression of Observation 3 on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

14. Regression of CAT Vocabulary Total on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

15. Regression of CAT Reading Comprehension on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

16. Regression of CAT Total on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

17. Regression of RTLA Tests 1, 2, 3 on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

18. Regression of RTLA Total on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

19. Regression of Observation III on Observation I for Linguistics (L) and Whole Word (W.W.) Treatments.

20. Regression of RTLA Total on Observation I for Linguistics (L) and Whole Word (W. W.) Treatments.

21. Regression of Experimental Visual II on ITPA Auditory I for Linguistics (L) and Whole Word (W.W.) Treatments.

22. Regression of Experimental CAT Total on MRRT Total for Linguistics (T) and Whole Word (W.W.) Treatments.

23. Regression of Experimental RTLA Total on MRRT Total for Linguistics (L) and Whole Word (W.W.) Treatments.

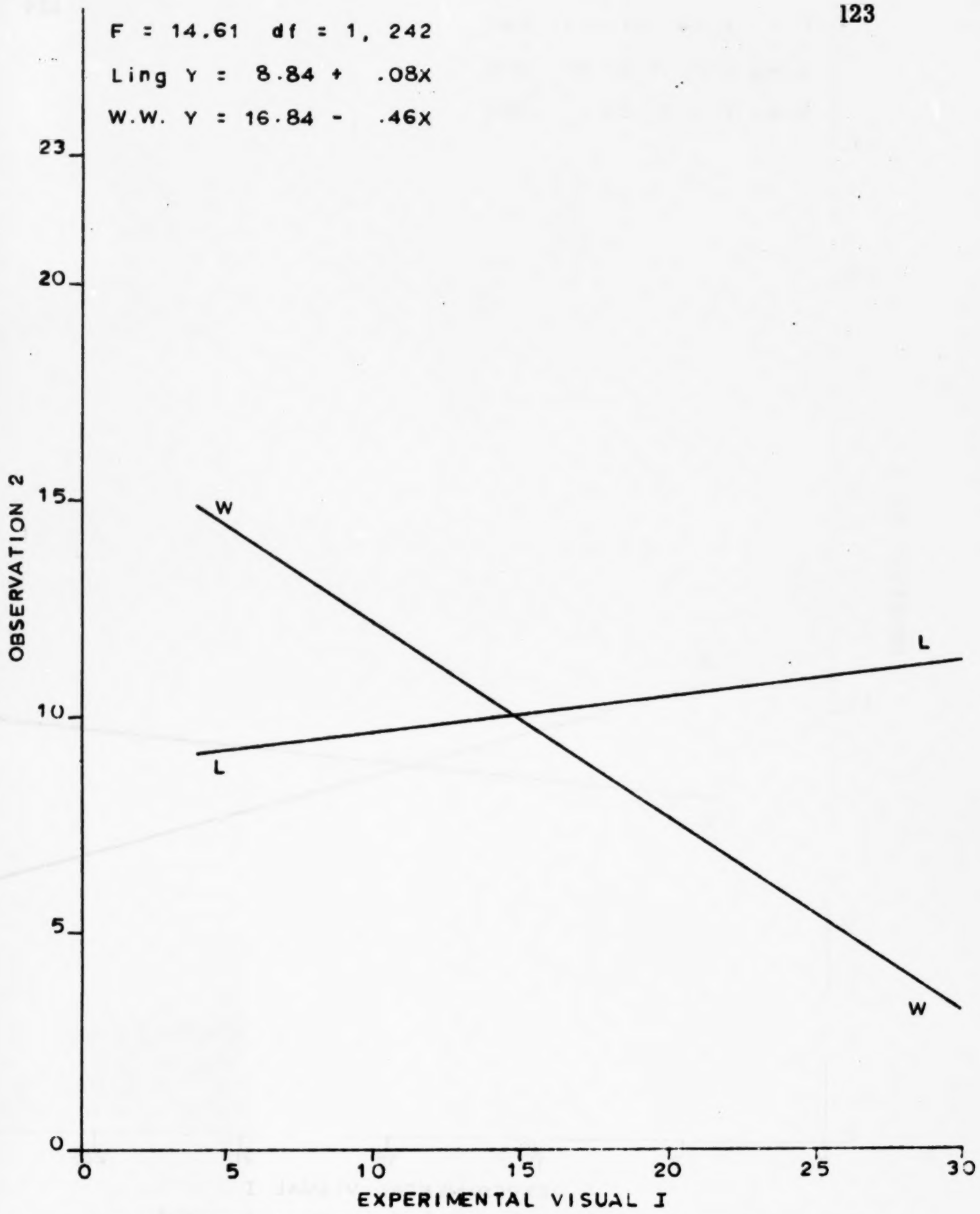

Fig. 12--Regression of Observation 2 on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

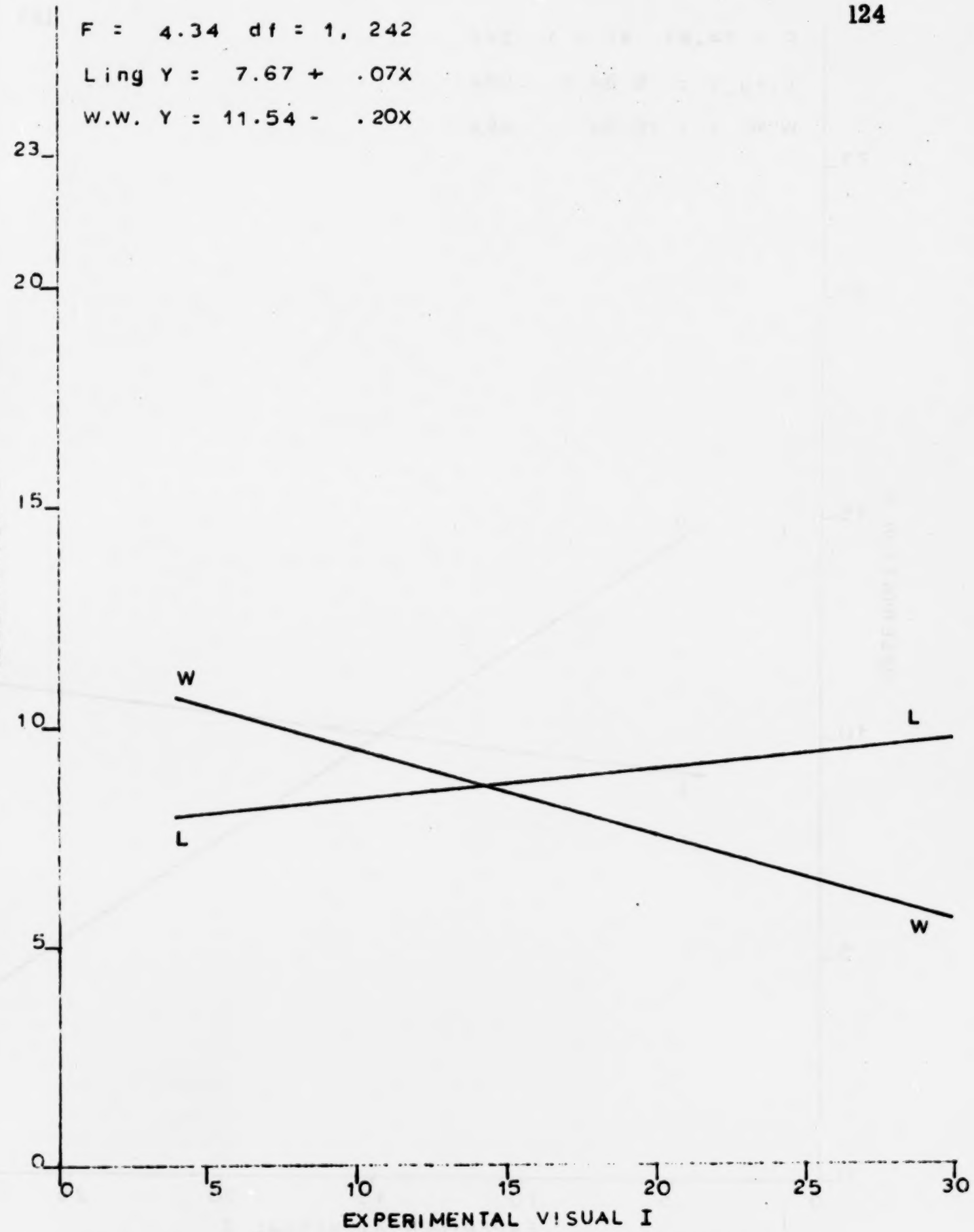

Fig. 13--Regression of Observation 3 on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

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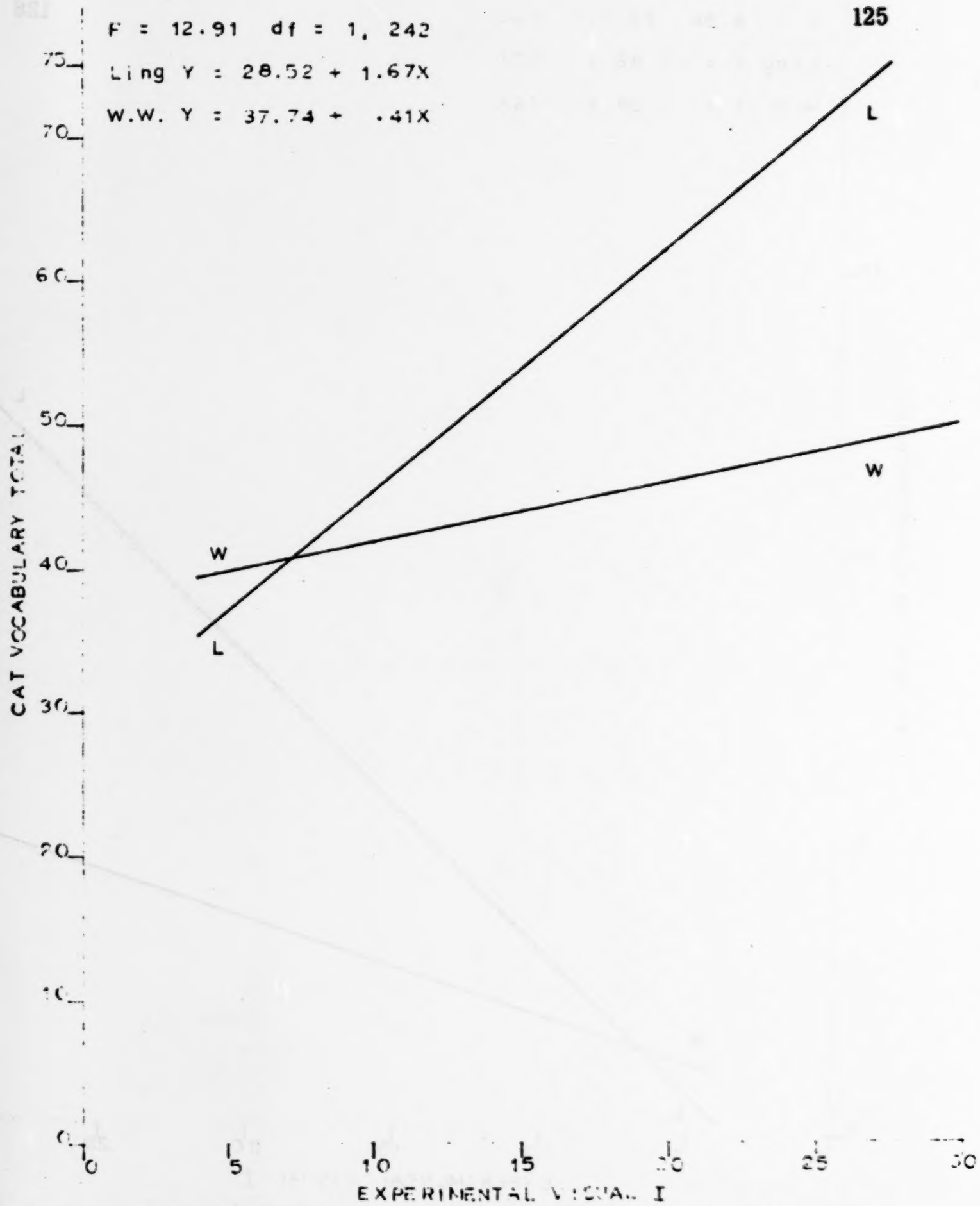

Fig. 14--Regression of CAT Vocabulary Total on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

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F = 8.96 df = 1, 242

Ling Y = -1.88 + .50X

W.W. Y = .39 + .16X

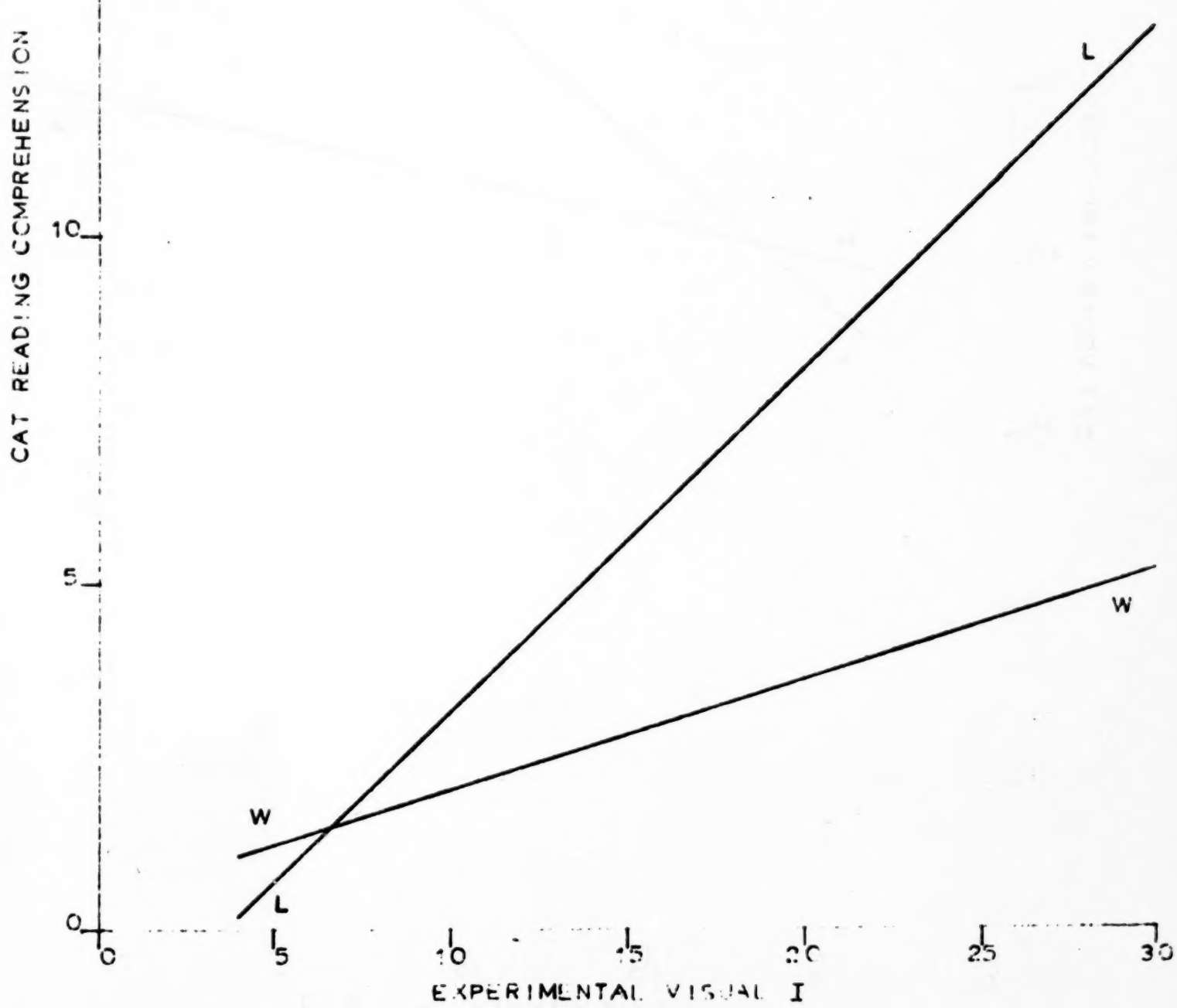

Fig. 15--Regression of CAT Reading Comprehension on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

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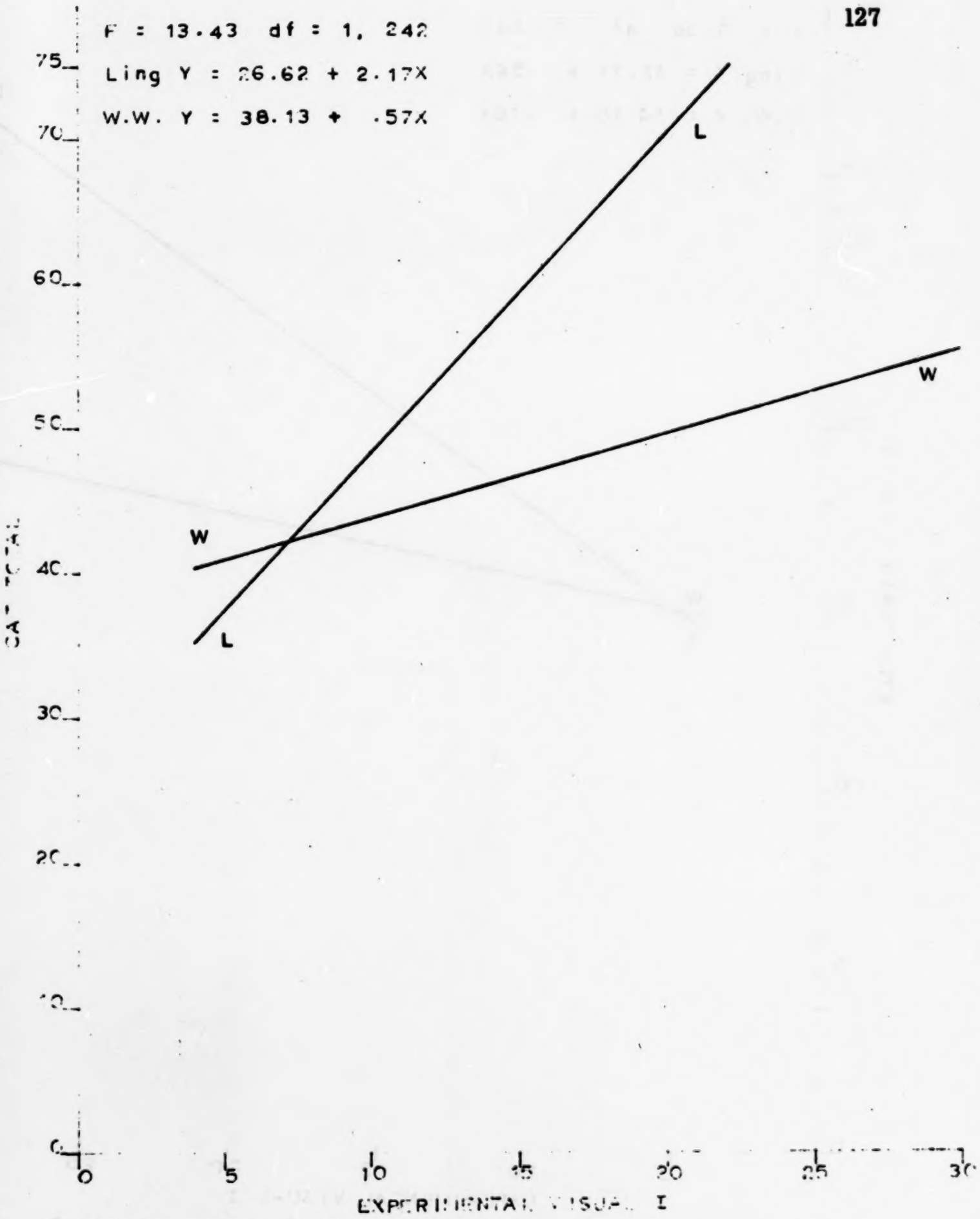

Fig. 16--Regression of CAT Total on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

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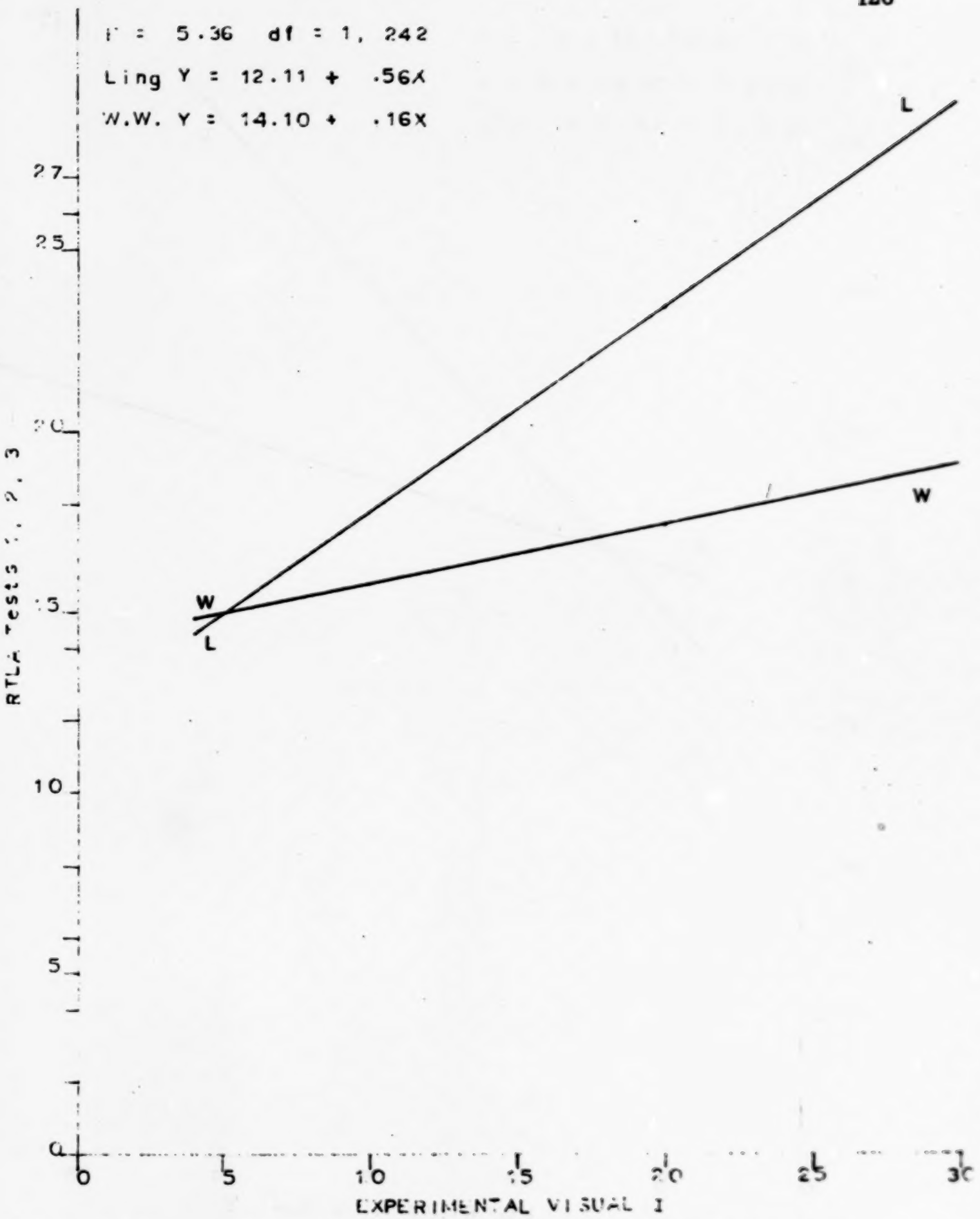

Fig. 17--Regression of RTLA Tests 1, 2, 3 on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

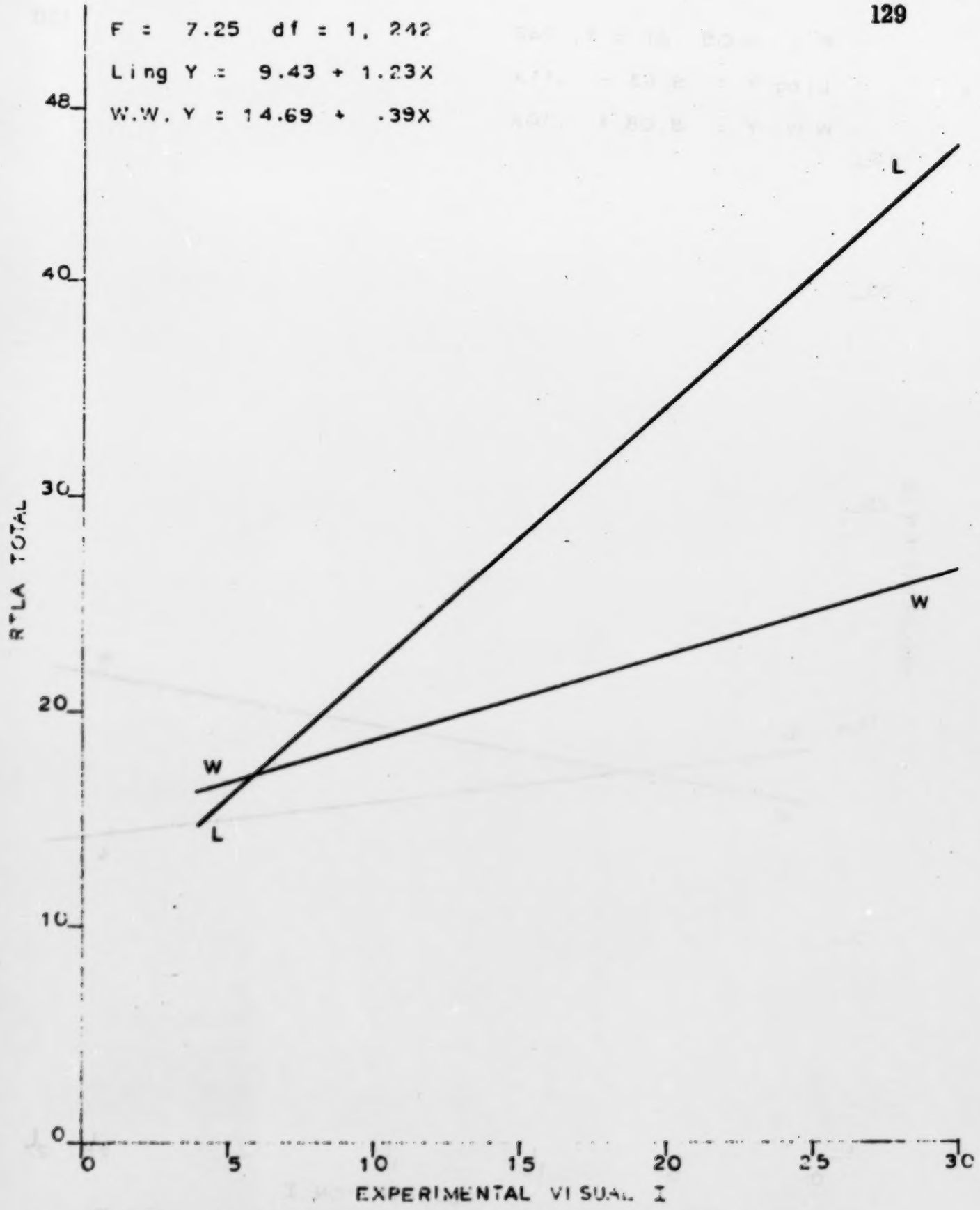

Fig. 18--Regression of RTLA Total on Experimental Visual I for Linguistics (L) and Whole Word (W.W.) Treatments.

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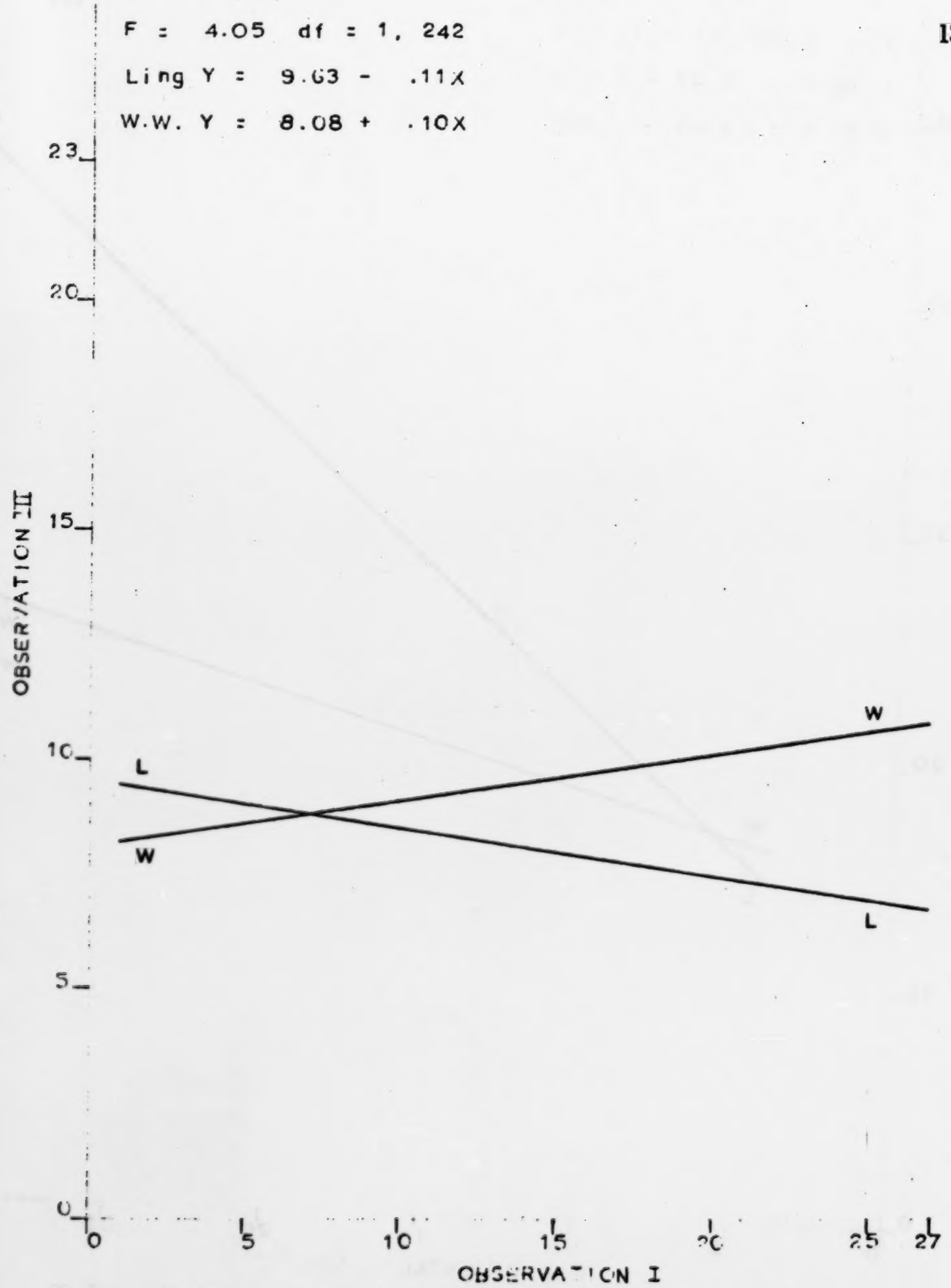

Fig. 19--Regression of Observation III on Observation I for Linguistics (L) and Whole Word (W.W.) Treatments.

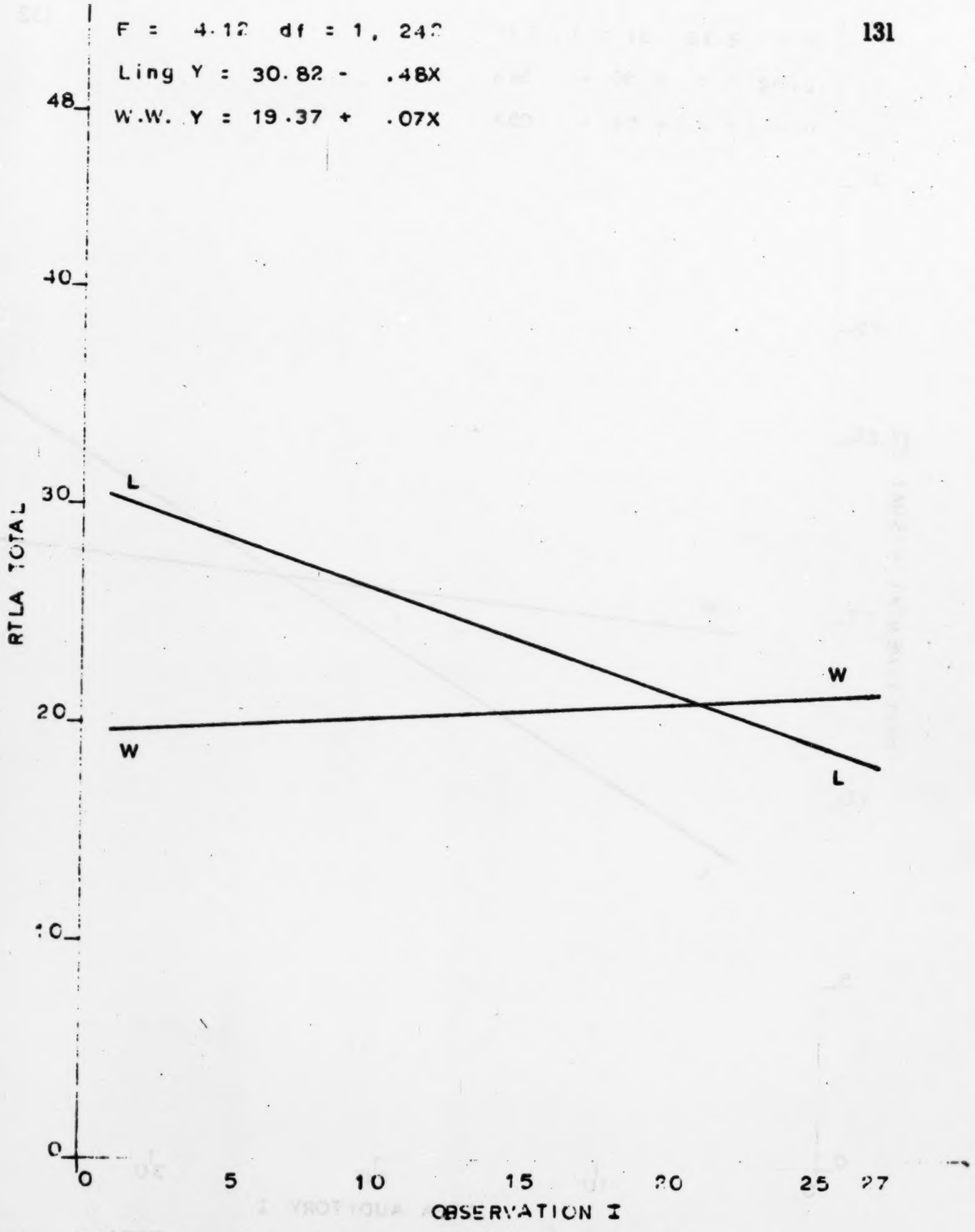

Fig. 20--Regression of RTLA Total on Observation I for Linguistics (L) and Whole Word (W.W.) Treatments.

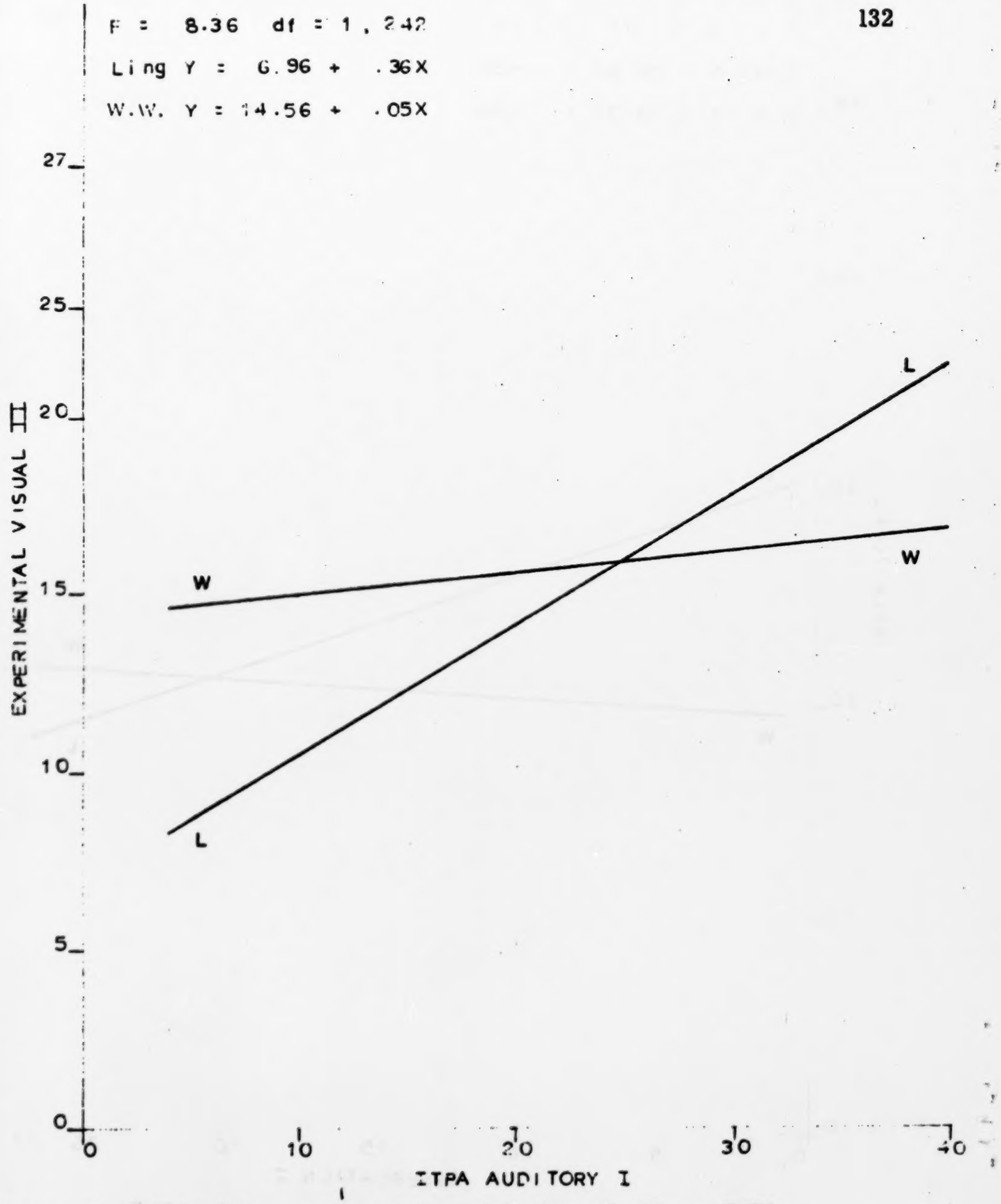

Fig. 21--Regression of Experimental Visual II on ITPA Auditory I for Linguistics (L) and Whole Word (W.W.) Treatments.

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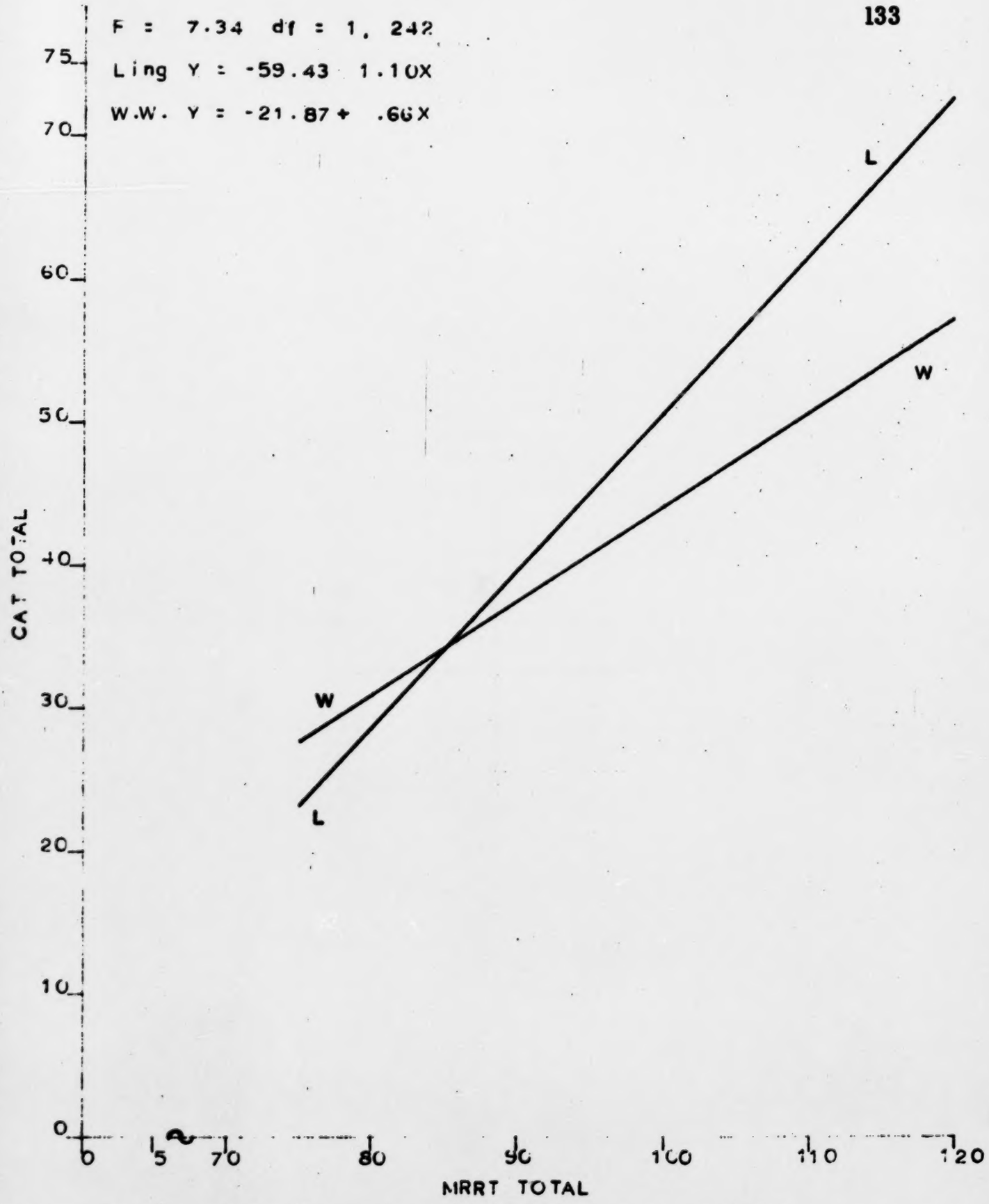

Fig. 22--Regression of Experimental CAT Total on MRRT Total for Linguistics (L) and Whole Word (W.W.) Treatments.

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